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Liu (C. L.). **Contributions to the Knowledge of Chinese Coccinellidae. VI. Occurrence of *Perilitus coccinellae* (Schrank), a Parasite of adult Coccinellidae, in Yunnan (Hymenoptera, Braconidae).**—*Ent. News* **55** no. 9 pp. 235–237, 1 ref. Lancaster, Pa., 1944.

Perilitus (*Dinocampus*) *coccinellae*, Schr. [*cf. R.A.E.*, A **15** 137] was found in small numbers parasitising adults of *Coccinella septempunctata*, L., *Adonia variegata*, Goeze, and *Macronaemia hauseri*, Weise, in Yunnan in 1939–42. In the laboratory, it successfully parasitised *C. septempunctata*, but not *Coelophora biplagiata*, Swartz, *Chilomenes sexmaculata*, F., *Halyzia sanscrita*, Muls., or an undescribed species of *Epilachna*.

Denne (W.), Spiller (D.) & Kelsey (J. M.). **Research on *Anobium punctatum* De Geer. The Flight Period at Auckland.**—*N.Z.J. Sci. Tech.* **26** (A) no. 3 pp. 152–154, 1 fig., 3 refs. Wellington, N.Z., 1944.

Records were made of the dates of emergence of over 15,000 adults of *Anobium punctatum*, Deg., from timber in various parts of Auckland, New Zealand, over a period of three years. No beetles were collected before mid-October or after January, and the main emergence occurred over five weeks from the beginning of December [*cf. R.A.E.*, A **32** 336].

A new Disease of Carrots.—*Agric. Gaz. N.S.W.* **55** pt. 11 pp. 493–494, 3 figs. Sydney, 1944.

The virus disease of carrots recently recorded from Victoria [*cf. R.A.E.*, A **33** 292], has also been found in New South Wales, where it is believed to have been established for a long time. Its occurrence in outbreak form is always associated with heavy infestation by its vector, *Cavariella aegopodii*, Scop., and the malformation, yellowing and stunting of the plants have previously been attributed to direct Aphid injury. The symptoms of the disease are described [*cf. loc. cit.*]. In general it is most severe in spring sowings made from July onwards; carrots sown from mid-December until the end of January remain healthy and mature normally, but sowings made after this date have become infected later in the autumn.

Smith (J. H.) & Atherton (D. O.). **Seed-harvesting and other Ants in the Tobacco-growing Districts of north Queensland.**—*Qd J. agric. Sci.* **1** no. 3 pp. 33–61, 11 figs., 7 refs. Brisbane, 1944.

The following is based on the authors' summary of an investigation on tobacco seed-bed failures caused by indigenous ants in north Queensland. The funnel ant, *Aphaenogaster longiceps*, F. Sm., was a serious pest because of the ramifications of the nest and the soil disturbance associated with the formicary. The chief seed-harvesting species were *Monomorium rothsteini*, Forel, var. *leda*, Forel, *Pheidole impressiceps*, Mayr, *P. variabilis*, Mayr, and *P.* (*Pheidolacanthinus*) *mjöbergi*, Forel. The bionomics of these and of some other species are described. Examination of the nests showed that to some extent the contents of the granaries reflected the variety of the flora in the vicinity and the species of plants shedding seed for some weeks before. Sampling of nests in tobacco-growing districts showed that species that do not harvest seed preponderate in the coarse white sands and seed-harvesting species in the river silts; brown sands contain numerous nests of both types. An explanation of the species distribution, based on the reaction of individual species to the physical characteristics of the soil and on an analysis of available food materials, is suggested.

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Losses from seed-harvesting ants may be eliminated by establishing seed-beds some distance away from the nests of the more distinctive species, by destroying nests on the site before preparing the seed-bed, or by applying sand covers immediately after sowing the seed ; the river sand retained on a 16-mesh sieve, applied to a depth of one-eighth of an inch, gives adequate protection [*cf. R.A.E.*, A **22** 23]. Baits are sometimes necessary to prevent damage by ants that harvest the cotyledons from seedlings. These ants collect maize meal more readily than either tobacco seed or the cotyledons and broadcast applications of the meal at a rate of 12 oz. per 100 sq. ft. on and near the seed-beds give effective protection ; the addition of a poison to the bait is unnecessary, as nest destruction is of secondary importance.

A list of herbaceous plants collected in tobacco-growing districts, showing those of which the seeds were found in granaries of *M. rothsteini* var. *leda*, *P. impressiceps* and *P. mjöbergi*, and a list of the ants found in the two districts in which investigations were carried out are appended.

MACKIE (J. R.). **Annual Report on the Agricultural Department (Nigeria) for the Year 1943.**—34 pp. Lagos, 1944.

This report includes brief sections on insect pests in Nigeria. Small concentrations of the solitary phase of the African migratory locust [*Locusta migratoria migratorioides*, R. & F.] were found in irrigated wheat-fields near Lake Chad in April 1943, but no swarms were recorded. The desert locust [*Schistocerca gregaria*, Forsk.] migrated eastwards across the narrow belt between 12°N. lat. and the northern frontier in late May and June and bred, for the first time on record in Nigeria, in August. Areas in the north-east and north-west were affected, both being extensions of hopper outbreaks in French Niger. There were 27 reports of swarms of the new generation between 1st October and 11th December, after which locusts were absent until the middle of March, when swarms entered Ilorin Province from the west and migrated eastwards, reaching the extreme east of the Protectorate in early April.

The other pests recorded are the Bruchids, *Pachymerus lacerdae*, Chevr., in stored and fallen nuts of oil palm [*Elaeis guineënsis*] in Benin [*R.A.E.*, A **33** 165], and *P. longus*, Pic, which infested unshelled ground-nuts [*Arachis hypogaea*] in native stores in eastern Nigeria in 1939 and was subsequently found to be widely distributed there ; and a Lygaeid, probably *Aphanus sordidus*, F., which attacked shelled ground-nuts stored in bulk in mud buildings at Yola, in eastern Nigeria, but appeared to cause little damage to ground-nuts in bags.

MOUTIA (A.). **Division of Entomology.**—*Rep. Dep. Agric. Mauritius 1943* pp. 12–15. Port Louis, 1944.

No comprehensive surveys of the status of *Clemora* (*Phytalus*) *smithi*, Arr., on sugar-cane were carried out in Mauritius in 1943, but one new focus of infestation was recorded in the south and one estate became reinfested, though not heavily. The use of resistant varieties and the action of parasites [*R.A.E.*, A **31** 160] are thought to be responsible for the absence of severe attack in recent years despite the cessation of hand-collection. No very heavy outbreaks of *Proceras sacchariphagus*, Bojer, occurred on sugar-cane during the year. About 157,000 adults of the parasite, *Trichogramma australicum*, Gir. [*cf.* **31** 161 ; **32** 338] were reared during January–April, when its breeding was discontinued owing to lack of food-supplies for the laboratory hosts, *Corcyra* [*cephalonica*, Staint.] and *Sitotroga* [*cerealella*, Ol.] ; 77,000 and 32,000 were liberated against *Proceras* at two sites. There was little change in the status of *Chionaspis* (*Aulacaspis*) *tegalensis*, Zehnt., on sugar-cane, but a new centre of infestation was recorded on the variety P.O.J. 2878 in the south. The predacious

Coccinellids, *Chilocorus politus*, Muls., *C. nigritus*, F., and *Cybocephalus* sp., were fairly abundant.

Young maize plants were damaged by cutworms and by *Crambus malacellus*, Dup., and older plantations by *Sesamia vuteria*, Stoll. The practice of growing trap plants in fields subsequently to be sown with maize, especially where *C. malacellus* is abundant, gave good results, but cleaning the fields by burning prior to sowing was generally followed by severe infestation. Sweet potatoes in one field were heavily infested by *Elachista* sp., but the plants recovered as soon as there was sufficient rain to promote rapid growth. Large numbers of mynah birds (*Acridotheres tristis*) preyed on the sweet-potato leaf-roller, *Trichoptilus wahlbergi*, Zell., in some heavily-infested fields. In a survey of rice pests, *C. malacellus* was found to be the most important; transplanted seedlings are more vigorous and appear to be more resistant to attack than others. *S. vuteria* was uncommon on rice. Forest pests recorded during the year included *Xyleborus camphorae*, Hag., on *Pinus taeda*, *Heterobostrychus aequalis*, Waterh., and *Bostrychoplites cornutus*, Ol., on *Eucalyptus*, and *Sinoxylon conigerum*, Gerst., on *Eucalyptus* and *Terminalia*.

In experiments in which the rate of application was 1 cc. per kg., carbon tetrachloride and orthodichlorbenzene were found to be the best fumigants for controlling *Bruchus* spp. in stored beans; the exposure period was 84 hours. Petrol, which is more readily available, also gave good results [*cf.* **31** 183] and was recommended for use, with a fumigation period of 24 hours, followed by exposure to the sun. An emulsion of Diesel oil and clay [*cf.* **31** 161] was most effective at a concentration of 5 per cent. oil as a contact insecticide for treating nests of *Solenopsis geminata*, F., and gave good results as a repellent against this ant in seed-beds at 0·6 per cent.

GARDNER (J. C. M.). **A Note on the Protection of Timber from certain Borers.** —*Indian For. Leafl.* no. 69, [2 +] 4 pp. Dehra Dun, 1944.

Much timber has recently been required for emergency purposes in India and losses due to Bostrychids (powder post beetles), which attack the sapwood in timber from broad-leaved trees, have been very great, owing to the impracticability of impregnating the wood with preservatives that afford permanent protection. Several simple methods designed to give at least temporary protection were accordingly tested. Aqueous solutions of zinc chloride or arsenical salts, applied by swabbing or dipping, did not give satisfactory results, but when barked and unbarked poles made from *Dalbergia sissoo* were thoroughly swabbed with a mixture of creosote and fuel oil (1 : 1 or 1 : 4), and kept under shelter, they were free from infestation by *Sinoxylon* spp. nine months later, whereas the controls were heavily attacked. Lime-wash gave promising results against Bostrychids in dry wood in preliminary tests in 1943, and further experiments were accordingly made in 1944 on timber shown to have a high starch content. Branches of mango (*Mangifera indica*) 4–14 ins. in diameter were sawn into 4-ft. lengths, and, after removal of the bark, given a single application of lime-wash within three days of felling and stored under cover. Three months later they were still uninfested, though some of the controls showed more than 40 exit holes. Planks, $1\frac{1}{4}$ ins. thick and 7 ft. long, that were sawn from a trunk of *Albizzia procera* and were treated in a similar manner, were still free from infestation after $2\frac{1}{2}$ months, whereas the untreated controls contained an average of 20 exit holes of *S. anale*, Lesne, and one contained 59. The wash was in both cases thick enough to give a uniform, opaque covering with a single application. The addition of an adhesive was not necessary, but one would be required on smooth surfaces, such as bamboo, and probably also on timber to be exposed to rain. Kuppuswami reported in 1939 that an application of lime-wash every six months protects building timber from

attack by *Xylocopa* spp., and Rai Sahib Muljee recently found that planks or logs of *Boswellia serrata* are best protected against insects and fungi by means of a lime-wash used as a paint or a dip. All these treatments must be carried out within a few days of felling, and new cuts and cracks must be treated immediately.

FITZGERALD (J. S.). **The Effectiveness of various Mineral Dusts for the Control of Grain Pests.**—*Bull. Coun. sci. industr. Res. Aust.* no. 182, 27 pp., 20 refs., multigraph. Melbourne, 1944.

The following is based on the author's summary of this account of recent laboratory experiments in Australia on the value of inert mineral dusts for the control of insects, particularly *Calandra granaria*, L., and *C. oryzae*, L., in stored wheat [*cf. R.A.E.*, A **31** 45; **32** 38–40, etc.]. The results confirmed previous conclusions that several materials, chiefly minerals, are lethal to various degrees; that the most effective particles are those with diameters of less than ten microns [*cf.* **32** 312]; that the effect is less pronounced at 75 per cent. relative humidity than at 40 or 60 per cent.; and that *C. oryzae* is more susceptible than *C. granaria* [*cf.* **33** 319].

It was found that minerals capable of killing grain weevils in wheat when finely ground are available in all the grain-producing States of Australia and that they have a sufficiently high proportion of the desired small particles when commercially ground to a dust most of which passes a 200-mesh sieve. The more effective dusts gave good kills even at 75 per cent. relative humidity, but longer periods were necessary to obtain very high kills at the higher humidities. It was also found that although *Calandra* spp. are killed relatively slowly by these dusts, there is considerable restriction of oviposition, probably owing to blocking of the mouth-parts, which are used to make the holes in which the eggs are deposited, and that even moderately effective dusts exert a marked degree of control in the course of several generations. The dosage required to protect wheat differs according to the dust and the humidity, but for effective dusts, 0·25–0·5 per cent. of the weight of the grain appears sufficient to retard weevil development. Dust mixed with grain containing about 12 per cent. moisture did not diminish in effectiveness even after two months. *Rhizopertha dominica*, F., was more resistant to dusts than *Calandra* spp., but there was again some restriction of breeding, though the cause is unknown, and it is considered that dusts that are effective against *Calandra* will give considerable control of *Rhizopertha* in the course of several generations.

No one material proved outstanding in these tests. Of the different forms of silica, Naaki was less effective than was expected from published reports [*cf.* **33** 231, etc.], Neosyl was the most effective material used, and some diatomaceous earths proved effective when calcined, but none of these materials can be used in practice because of the danger to health involved in handling wheat treated with them. Samples of magnesite from several Australian deposits were very effective against *Calandra*, but others gave poorer results; in tests with *Rhizopertha*, magnesite was less effective than dolomite or limonite [*cf.* **32** 139]. Dolomite was less effective than magnesite against *Calandra*, but is worth considering for commercial use since it is a cheap material. Limonite gave erratic results, and the promising results obtained in short tests with one sample were not confirmed in the longer ones; the colour of this dust renders it undesirable for commercial use. Various forms of calcium carbonate (limestone) gave poor results, the best being effective only at the lower humidities. Hydrated lime gave a good kill of *Calandra* spp. but is apparently not particularly effective in reducing oviposition, as it did not give a high degree of control in the longer tests; this comparative loss in effectiveness did not occur in the case of *Rhizopertha*.

SMITH (R. H.). **Bionomics and Control of the Nigra Scale,** *Saissetia nigra.*— *Hilgardia* **16** no. 5 pp. 225–288, 21 figs., 4 pp. refs. Berkeley, Calif., 1944.

Saissetia nigra, Nietn., has been an important pest of ornamental shrubs and trees in the coastal region of California for many years, and there has been some anxiety in the State lest it should become a pest of *Citrus*, avocado and other subtropical fruits. A comprehensive study of the Coccid was therefore carried out mainly during 1937–40, when it was exceedingly prevalent in the coastal region from Sonoma County to San Diego County, and the results are given in detail and correlated with information from the literature.

The author describes the early history of the Coccid in California and its establishment and increase in various counties [*cf. R.A.E.*, A **29** 114], gives details of its geographical distribution in California, in the rest of the United States and in other parts of the world, and discusses its synonymy and the popular names by which it has been known [*cf.* **29** 564]. He gives detailed descriptions of all stages and characteristics by which it can be distinguished from similar species infesting shrubs and trees in California and lists of its food-plants in California, with notes on their susceptibility to infestation, and of the plants on which it has been recorded outside the State, showing the localities in which infestation occurred, and discusses the characteristics of preferred food-plants, the diversity in the species and botanical nature of plants attacked, the adaptation of the scale to plants that are not commonly infested, and evidence of the development of strains specific to certain food-plants. It is shown that *S. nigra* thrives under a wide range of environmental conditions, and characteristics of infestation and the shape of the scale on different species are described.

Damage to plants is caused by mechanical injury due to the insertion of the rostralis into the tissues, toxic effects due to injection of saliva into the tissues, and devitalisation of the plant due to the removal of sap or other constituents in liquid form, and by the excretion of honeydew, on which sooty mould develops, on the leaves. Feeding appears to cause no deformation of the infested parts and no necrosis of tissue, but infested plants or parts of plants exhibit a retardation in growth and an accentuated ageing and shedding of leaves, which is, however, slight unless the plants are growing under unfavourable conditions. In addition to attacking ornamental plants, *S. nigra* has been recorded in various parts of the world as a pest of minor importance on 32 species of fruits and nuts and on 14 other species of plants, including cotton. It has been found on *Citrus* in various countries and occasionally in California, where two rather heavy infestations suggest that this plant is susceptible to attack.

The scale has one generation in the year in California and reaches the adult stage in April, May or June. Some individuals die by mid-summer, but others live throughout the autumn and winter, and oviposition takes place continuously for 9–10 months, from about the middle of May until February, though most eggs are laid in May-September. The duration of the egg stage varies from about five days in warm summer weather to a month or more in autumn and winter. The nymphs grow very little until February, March and April, and those that hatch in December and January apparently reach the adult stage at about the same time as those that hatched the preceding May. Many remain in a fixed position from the time they first settle, but movement may take place in any part of the period of 8–9 months from the time of settling until the pre-adult stage, considerable migration taking place after the second ecdysis. The average number of eggs per scale from 25th July to 10th December 1940 was 628. No males were found, and reproduction is considered to be entirely parthenogenetic in California. Natural mortality is very heavy in the immature stages.

Records are given from the literature of predators attacking the Coccid in various places; those found in California were the Coccinellids, *Chilocorus stigma*, Say (*bivulnerus*, Muls.), *Cycloneda munda*, Say, *Olla abdominalis*, Say, *Adalia bipunctata*, L., *Rhizobius ventralis*, Erichs., *Lindorus lophanthae*, Blaisd., and one or more species of *Scymnus*, the Neuroptera, *Chrysopa californica*, Coq., *Hemerobius pacificus*, Banks, and *Conwentzia hageni*, Banks, the thrips, *Leptothrips mali*, Fitch, and a number of Diptera, Lepidoptera, Hemiptera and mites. The Hymenopterous parasites recorded from the scale comprise *Anysis saissetiae*, Ashm., in the Philippines, *Aneristus ceroplastae*, How., *Coccophagus hawaiiensis*, Timb., *Encyrtus barbatus*, Timb., *Eucomys* (*Encyrtus*) *infelix*, Embleton, *Microterys flavus*, How., *M. kotinskyi*, Fullaway, *Quaylea whittieri*, Gir., *Scutellista cyanea*, Motsch., and *Tomocera californica*, How., in Hawaii, *C. isipingoensis*, Comp., in the Transvaal, *C. modestus*, Silv., in Dahomey, *Metaphycus stanleyi*, Comp., in Kenya, *A. ceroplastae*, *Encyrtus* sp., and *Diversinervus elegans*, Silv., in Australia, *A. ceroplastae*, *C. scutellaris*, Dalm., *Eupelmus coccidivorus*, Gah., *Marietta* sp., and *Thysanus* sp. in Porto Rico [*cf.* **32** 344], *Lecaniobius cockerelli*, Ashm., in British Guiana and several islands in the West Indies, including Porto Rico, *E. coccidivorus* and *C. saissetiae*, Gah., in Panama, and *C. cowperi*, Gir., *C. ochraceus*, How., *C. pulvinariae*, Comp., *Metaphycus helvolus*, Comp. [*cf.* **31** 245], *Q. whittieri* and *S. cyanea* in California. Of these *E. coccidivorus*, *Q. whittieri*, *Marietta* sp. and *Thysanus* sp. are hyperparasites. *Metaphycus helvolus* and *S. cyanea* have been of considerable importance in the natural control of the scale in California, and in 1938–39, *C. rusti*, Comp., *M. stanleyi*, *D. smithi*, Comp., and a species of *Mesopeltis*, all of which were introduced from Africa in 1936–37 and are parasites of *Saissetia oleae*, Bern., were released against *S. nigra*, but no recoveries were made from this species. It is reported to be attacked by several species of fungi in other parts of the world [*cf.* **15** 622; **16** 445], but none has been observed in California.

During 1936–38, natural enemies appeared to be of little importance in the control of *S. nigra* in California, but in 1939 they became exceedingly effective in the southern coastal districts, where adults were heavily attacked by *Scutellista cyanea*, *Rhizobius ventralis* and *Lindorus lophanthae*. During the winter, while oviposition and hatching continued to diminish until all adult scales had died, predators and parasites maintained their supremacy and almost exterminated the young scales, even in localities that had escaped the full force of their attack in the preceding months. *M. helvolus* became increasingly effective in the winter and was afterwards an important natural enemy. In 1940, there was no widespread infestation by the Coccid in the southern coastal districts. In the northern region, where infestation had never been so heavy or so widespread as in the south, it continued to be about the same in 1939 and 1940 as in previous years.

In tests with sprays, highly refined light-medium oil sprays (summer oil) were superior to preparations of pyrethrum, rotenone and nicotine in controlling the scale, and it is recommended that drenching sprays of 2 gals. oil emulsion or $1\frac{1}{2}$–$1\frac{2}{3}$ gals. emulsive oil per 100 gals. water should be applied in September, October or November.

FLANDERS (S. E.). **Observations on *Comperiella bifasciata*, an Endoparasite of Diaspine Coccids.**—*Ann. ent. Soc. Amer.* **37** no. 3 pp. 365–371, 1 fig., 15 refs. Columbus, Ohio, 1944.

The hosts of *Comperiella bifasciata*, How., include *Aonidiella taxus*, Leon., in Japan, *A. orientalis*, Newst., in India, and *Chrysomphalus dictyospermi*, Morg., and *C. bifasciculatus*, Ferr., in China, and it has been reared from *A. eremocitri*, McKenzie, by the author. It is also a common parasite of *A. citrina*, Coq., throughout its range in Japan, China and India, but is known to attack *A.*

aurantii, Mask., only in China, although the two species occur together elsewhere [*cf. R.A.E.*, A **31** 328]. Accounts are given of cross-breeding experiments with the races from China and Japan reared in *A. aurantii* in California, the salient features of which have already been noticed [**31** 271], and of observations on the development of the Chinese race in *A. aurantii*. The latter showed that development of the host lasts about 38 days and that of the parasite 20–40 days at a constant temperature of about 80°F.; the approximate minimum duration of the life-cycle of the parasite at various places in southern California in summer varies from 30 to 50 days. About half the progeny of mated females are males, unless the eggs are laid in mature Coccids, when females predominate, possibly as a result of the increase in time required for oviposition in mature hosts, which allows more of the eggs to become fertilised [*cf.* **27** 595].

DE FIGUEIREDO jr. (E. R.) & LIMA (L.). *Bruchophagus gibbus* **(Boh.) parasito da semente da alfalfa.** [*B. gibbus*, a Pest of Lucerne Seed.]—*Bol. Agric.* **41** (1940) pp. 307–316, 6 figs., 9 refs. São Paulo, 1942. [Recd. 1945.]

Consignments of lucerne seed arriving at Santos from France and from the Canary Islands were found to be infested by *Bruchophagus gibbus*, Boh., (*funebris*, How.), which does not occur in São Paulo. In view of the importance of this Eurytomid in other parts of the world, accounts are given from the literature of its world distribution, life-history in the United States and control, including a list of nine parasites and a predator recorded in the United States [*R.A.E.*, A **8** 361], and all stages except the pupa are described.

TEIXEIRA MENDES (C.). **O expurgo das sementes.** [Seed Disinfestation.]—*Bol. Agric.* **42** (1941) pp. 225–280, 2 pls., refs. São Paulo, 1943. [Recd. 1945.]

The author describes at some length the methods that have been in use in São Paulo, Brazil, to free cottonseed from infestation by *Platyedra gossypiella*, Saund., and gives a detailed account of investigations there to ascertain the best methods for this purpose and also for controlling *Calandra* (*Sitophilus*) *oryzae*, L., and *Sitotroga cerealella*, Ol., in stored maize. He concludes from the work that the most effective treatments for cottonseed are exposure to the direct rays of the sun, so that the seeds are subjected to a temperature of at least 60°C. [140°F.] for 2 hours, immersion for 15–20 minutes in water at a temperature of 55–58°C. [131–136°F.], and fumigation in air-tight containers with petrol used at a rate of 1 fl. oz. per cu. ft. for containers not more than two-thirds full, and at two or three times this rate for others. The next best treatment is vacuum fumigation with carbon bisulphide applied at the rate of 1 fl. oz. per cu. ft., with an exposure of 3–4 hours. None of these treatments caused any serious diminution in germinating power.

The most effective treatment for large quantities of stored maize was found to be vacuum fumigation for 3–4 hours with carbon bisulphide at the rate of 2–3 fl. oz. per 10 cu. ft., which, however, causes some loss of germinating power. Small lots of maize stored in air-tight tins can be protected by treatment with petrol at the rate of 2 fl. oz. per cu. ft., and this treatment, which is recommended for grain that is to be used for seed, only slightly reduced germination after storage for a year.

MUGGERIDGE (J.). **Record of an Australian Fly** (*Metoponia rubriceps*, **Macquart) found in Pastures in Opotiki.**—*N.Z. J. Sci. Tech.* **26** (A) no. 4 pp. 190–192, 3 figs., 2 refs. Wellington, N.Z., 1944.

In a locality in the North Island of New Zealand in which *Metoponia rubriceps*, Macq., was prevalent, large numbers of larvae of this Stratiomyiid could frequently be found about the roots of grasses within 2–3 ins. of the ground

surface wherever a pasture of rye-grass [*Lolium*] was seriously depleted [*cf.* *R.A.E.*, A **33** 269]. They occurred about the roots of maize and lupin as well as those of rye-grass. Farmers of the district have stated that attacks on maize grown in ploughed grassland are usually serious in the first year after ploughing, but are much reduced in the second year, whereas rye-grass is apparently not badly affected at first, but is seriously attacked after a year or two, with the result that the pasture is completely ruined.

GIVEN (B. B.). **Longevity of Diamond-back Moth (*Plutella maculipennis*) Adults in Relation to Nutrition.**—*N.Z. J. Sci. Tech.* **26** (A) no. 4 pp. 192–194, 2 figs., 3 refs. Wellington, N.Z., 1944.

In experiments in New Zealand during July–October, in which the temperature ranged from 27 to 77°F. with a mean of 49°, adults of *Plutella maculipennis*, Curt., lived for maximum periods of a little over 100 and 90 days, respectively, when fed continuously on honey solution or a mixture of honey and pollen comb (bee bread) and of 30–40 days when starved or given either food for one day only or water for one day or continuously. The numbers of viable eggs laid by females fed continuously was high, and rather higher when the food was honey and pollen than when it was honey only.

GIVEN (B. B.). **The relative Food-consumption of Diamond-back Moth and White Butterfly Larvae.**—*N.Z. J. Sci. Tech.* **26** (A) no. 4 pp. 195–197, 3 figs., 4 refs. Wellington, N.Z., 1944.

Investigations were carried out in New Zealand on the relative volumes of cabbage leaf consumed by larvae of *Plutella maculipennis*, Curt., and *Pieris rapae*, L., the differences in the durations of the feeding periods and the proportions of the entire life-cycle during which active feeding takes place, in order to determine the relation between population and damage for the two species. The feeding period of the larvae lasted 10·5 days for *Plutella* and 14·5 days for *Pieris* at 22°C. [71·6°F.], and the ratio of food consumed by the two species was approximately 1 : 2·4 from the time of hatching to the end of feeding by *Plutella* and 1 : 14·5 for the entire larval feeding periods. The preoviposition period is assumed to last four days at 20°C. [68°F.] in each species, and it is concluded from this and from data in the literature that the complete life-cycle at this temperature lasts 26·5 days for *Plutella* and 36 for *Pieris*, with feeding periods of 11 and 15·5 days, respectively. Calculations based on these figures showed that the ratio of damage per individual per day of the complete generation is 1 : 9·4.

GIVEN (B. B.). **Notes on the physical Ecology of *Diadromus* (*Thyraeella*) *collaris*, Grav.**—*N.Z. J. Sci. Tech.* **26** (A) no. 4 pp. 198–201, 2 graphs, 7 refs. Wellington, N.Z., 1944.

When the Ichneumonid, *Thyraeella* (*Diadromus*) *collaris*, Grav., was sent to New Zealand for the control of *Plutella maculipennis*, Curt. [*cf.* *R.A.E.*, A **28** 28], it was despatched in the larval or pupal stage in host pupae that were stored at about 45°F. during transit. Only about 1 per cent. survived, however, and investigations were therefore carried out on the thermal reactions of the parasites with a view to improving the method of transport. When parasitised pupae were stored at 4·5°C. [40·1°F.] for 14, 28 or 42 days and then incubated at 18°C. [64·4°F.], the mortality of the parasite averaged 50, 90 and 100 per cent., respectively, and when parasitised pupae were stored at 7·2°C. [44·96°F.] for 60 days, no parasites emerged, and dissection showed that all had died in the prepupal stage. When adult parasites packed as for transport were stored at 7·2°C., the mortality was approximately 20 per cent. after three days and

60 per cent. after 42 days ; all survivors of the longer period were females. It is therefore considered preferable to transport the parasite in the adult stage.

Experiments in which freshly parasitised pupae were kept at different constant temperatures and a constant relative humidity of 70 per cent. showed that the optimum temperature was about 29·5°C. [85·1°F.], at which the duration of development averaged 9·3 days, and the percentage mortality 4, and it was calculated from the results that the threshold of development was 7·6°C. [45·68°F.] and the thermal constant for the developmental period 200·1 [360·18] day-degrees. Mortality increased rapidly above the optimum temperature. The thermal constant cannot be used for calculating the possible annual number of generations at any locality, as it does not take into account the period between adult emergence and maximum oviposition. Relative humidity has little effect on the development of the pupae of *Plutella*, and hence on the pre-adult stages of the parasite, between 30 and 90 per cent., but below 30 per cent. the pupae become desiccated and above 90 per cent. they tend to develop bacterial infections.

Hogan (T. W.). **Pin-hole Borers of Fire-killed Mountain Ash. I. Survey and Field Observations.**—*J. Dep. Agric. Vict.* **42** pt. 11 pp. 513–520, 524, 5 figs., 1 ref. Melbourne, 1944.

The trees in most of the forests of mountain ash (*Eucalyptus regnans*) and alpine ash (*E. gigantea*) in the Central Highlands of Victoria, which cover an area of approximately 200,000 acres, were killed by fire in January 1939, and since such fire-killed timber deteriorates if left standing, owing to drying out and consequent cracking, salvage operations that involved felling and storage under conditions that retard loss of moisture became necessary. Under these conditions, however, attack by pin-hole borers occurs, and following reports of such attack, an investigation was begun in 1942. The two borers found in the felled timber were the Platypodid, *Platypus subgranosus*, Schedl, which was injurious mainly during the first three years after the fire, and an unidentified Lymexylonid, which did not become prevalent until the end of 1942, but causes more serious damage. The adults of the latter, which are as yet unknown, owing to the long life-cycle, apparently deposit their eggs in cracks in the surface of the logs, and the larvae bore into the wood towards the centre.

In trees that were felled, coated at the ends with a mixture of creosote and petrolatum, in order to delay drying out, and left on the forest floor, where the protection given by the growth of surrounding vegetation reduces the rate of drying, only the Platypodid was found early in 1942, and infestation was generally low in all but one area, where the canopy was intermediate in density, the trees were less severely burned and the initial infestation was high. Infestation was lowest at the two extremes of very dense canopy and complete exposure. Observations at the mills showed that damage of economic importance had occurred in some situations in spite of the general low level of infestation. The maximum depth of penetration was about 12 ins., but most of the tunnels did not penetrate more than 6–8 ins. ; the black stain associated with Platypodids occurred in proportion to the number of entries. It was nearly four years after the fire before traces of Lymexylonid attack were observed in salvage-felled logs. The infestation then increased steadily, but was still unimportant in the sixth year. No correlation was found in this case between canopy and infestation.

Logs that were headed, coated at the ends and hauled into stacks for extraction, were almost free from attack by the Platypodid after three years, probably owing to the rapid drying out of the wood, but after that time, infestation by the Lymexylonid increased rapidly, and early in 1944 all dry stacks showed heavy infestation in the inner logs. Where a higher proportion of a stack

was infested, the density of infestation was also greater. It is thought that laying the logs parallel instead of across each other would reduce both infestation and drying out. Stacks that were arranged so that they were under a continual spray of water showed no sign of insect attack.

Infestation by either borer was low in all districts in trees left standing, and it was found at the mills that the entries were extremely shallow; no damage of commercial importance had occurred. This is attributed to the enormous volume of susceptible material suddenly produced by the fire, as compared with the relatively small amount of breeding material available previously.

The extent of infestation by Platypodids is governed by the degree of susceptibility of the wood, which varies with the species of tree and its condition, the period over which the wood remains susceptible, which depends on the rate of drying, and the size of the population. In the districts concerned, *E. regnans* and *E. gigantea* did not seem to be so susceptible as *E. goniocalyx* or *Nothofagus cunninghami*. Lymexylonids do not seem to be attracted to green wood.

Bald (J. G.) & Norris (D. O.). **Virus C from an old Australian Variety of Potato.**—*Phytopathology* **35** no. 8 pp. 591–597, 1 fig., 9 refs. Lancaster, Pa., 1945.

An account is given of investigations on the symptoms, host-range and physical properties of a virus of potato in Australia that is thought to be identical with potato virus C. It is closely allied to virus Y [*Marmor cucumeris* var. *upsilon* of Holmes], but in experiments it was transmitted only rarely by *Myzus persicae*, Sulz., which is the most effective vector of virus Y.

Severin (H. H. P.) & Houston (B. R.). **Curly-top and California-aster-yellows Diseases of Flax.**—*Phytopathology* **35** no. 8 pp. 602–606, 4 figs., 2 refs. Lancaster, Pa., 1945.

Although flax had been shown experimentally to be susceptible to the virus of curly top [*Chlorogenus eutetticola* of Holmes], which is transmitted by *Eutettix tenellus*, Baker, infected plants were not observed in the field until March 1944, when the disease was found to be generally distributed throughout the flax-growing region of central California. The percentage infection was 5 in flax that had been planted early (October and November 1943) and decreased to 0 in late plantings. There had been little rain during October and November, so that the Jassids that dispersed from weeds in the valley at that time had little except cultivated crops to feed on, and the chief of these was flax. By the time that flax planted after November had reached the seedling stage, most of the Jassids had probably migrated to their winter quarters in the foothills. The symptoms of the disease in flax are described, and it is considered that the trend to earlier autumn planting will lead to increased risk of infection.

In experiments, the virus of California aster yellows [*Chlorogenus callistephi* var. *californicus* of Holmes] was transmitted to healthy flax by examples of *Macrosteles divisus*, Uhl., including the form with long elytra and the form with short ones [*cf. R.A.E.*, A **29** 302]. Nymphs of the latter form failed to complete their development, but a small population of adults of the form with long elytra was reared on flax.

Stoddard (E. M.), Gries (G. A.) & Plumb (G. H.). **Red Spider Control with Disodium Ethylene Bisdithiocarbamate.** (Abstract.)—*Phytopathology* **35** no. 8 p. 657. Lancaster, Pa., 1945.

In greenhouse experiments with sprays containing disodium ethylene bisdithiocarbamate (Dithane) and 0·00125 per cent. B-1956 spreader [a phthalic

glyceryl alkyd resin], the mobile stages of *Tetranychus bimaculatus*, Harvey, were killed by all concentrations above 0·125 per cent. Dithane, and most of the eggs by 0·6 per cent. The mites were controlled on strawberry and carnation by two applications at an interval of 10 days of a spray containing 0·15 per cent. Dithane with the spreader. Some discoloration of the foliage of carnation was caused at this concentration. This was reduced by omitting the spreader, but control was then also less. Spray injury on strawberry and peach was not severe at concentrations below about 0·5 per cent. The mites were not controlled by immersing the cut petioles of strawberry in various solutions of Dithane or by adding solutions to the soil, but *Paratetranychus ununguis*, Jac., was killed when the cut ends of spruce twigs were immersed in a 0·6 per cent. solution.

STARR (D. F.). **Use of a double-nozzled Spray Apparatus for the Application of DDT or Oils.**—*Science* **102** no. 2641 pp. 156–157. Lancaster, Pa., 1945.

Good deposits of 1, 1, 1-trichlor-2, 2-bis (p-chlorphenyl) ethane (DDT) were obtained in laboratory experiments by using a spray apparatus having two nozzles converging at an angle of about 35°, one emitting water and the other an atomised DDT solution. The droplets mixed about 2–4 cm. from the nozzles. If the DDT solutions were prepared with water-miscible solvents, such as acetone or alcohol, the insecticide was precipitated when the organic solution mixed with the water and was deposited immediately on the sprayed surface as nascent precipitates, some liquid and some solid. Deposits on glass were well distributed, and the type of the particle depended on the concentration of DDT and the solvent used. Oranges and apples were successfully sprayed by this method. Solutions of DDT in solvents not miscible with water were also successfully dispersed in this apparatus. Liquids such as mineral oil were dispersed in the water phase much as in an emulsion, but the system was so unstable that the water drained off the sprayed surface, leaving almost all the oil. The deposits of DDT on glass were very resistant to water applied in drops similar to rainfall, and the deposit on apples appeared to be washed off no more rapidly.

JANNONE (G.). **Sulle aree di diffusione dei parassiti delle piante in base ai rapporti di vicinato tra i vari paesi.** [The Distribution of Plant Parasites in Relation to Intercourse between various Countries.]—*Boll. Soc. ital. Med.* (*Sez. Eritrea*) **4** no. 1 pp. 153–165. Asmara, 1944. (With a Summary in English.)

The author discusses the extent to which international trade has been responsible for the spread of insect and other pests of plants, emphasises the necessity for adequate import regulations to prevent the entry of such pests and the harmful effect of war-time relaxation of them, and states that the potato moth, *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., was observed in Eritrea for the first time in 1943. It had evidently been introduced in 1942 and was attacked by two parasites, *Eulimneria* sp. and *Chelonus* (*Chelonella*) sp., which are believed to have been introduced with it.

SCHNEIDER-ORELLI (O.). **Entomologisches Praktikum.** [A practical Course on Entomology.]—8×5¼ ins., 149 pp., 68 figs. Aarau, H. R. Sauerländer & Co., 1945. Price *Fr.* 7.20.

This handbook is based on the author's experience as a university teacher in Switzerland. The early sections include information on the characteristics,

classification and metamorphosis of insects, and descriptions of techniques for preparing and mounting specimens. The main part of the book consists of detailed descriptions of the process of dissecting various insects chosen as representatives of their groups. Subsequent sections deal with the technique of breeding experiments, various Aphids and Coleoptera being selected as the examples, and, very briefly, with the principles of cultural, chemical and biological control, and with the collection and preservation of field material.

Bovien (P.) & Bolwig (N.). **Fortsatte Iakttagelser over** *Dexia rustica* **og dens Biologi.** [Further Observations on *D. rustica* and its Biology.]—*Tidsskr. Planteavl* **44** pp. 499–503, 2 figs. Copenhagen, 1940. (With a Summary in English.) [Recd. 1945.]

In continued observations in the laboratory on the biology of the Tachinid, *Dexia rustica*, F., which parasitises the larvae of *Melolontha* in Denmark [*cf. R.A.E.*, A **27** 518], it was found that the parasite larva enters its host through the cuticle [*cf.* **32** 324]. It attaches itself to the skin of its host, secretes a yellow fluid, and after about an hour bores directly in, without using its mouth-parts. It is thought that the secretion softens or dissolves the chitin. In order to leave its host, the third-instar larva frees itself from its spiracular funnel, feeds for a short time, possibly about two days, on the tissues of the host, which dies at this stage, bores its way partly out through the skin and then re-enters, leaving its posterior end outside. In this position it can both feed and breathe. After 2–3 days, it leaves the host altogether and pupates in the soil.

Of 347 larvae of *Melolontha* in the second, third and fourth years of development collected in various parts of Denmark in 1939, 59 were parasitised by *D. rustica*, the highest proportion of parasitised larvae being 9 out of one batch of 18 third-year larvae [*cf.* **27** 518].

Bovien (P.) & Stapel (C.). **Forsøg med Bekaempelse af Blommehvepsen** (*Hoplocampa fulvicornis*). [Experiments on the Control of the Plum Sawfly, *H. minuta*.]—*Tidsskr. Planteavl* **44** pp. 699–730, 5 figs., 12 refs.; also as *Beretn. Forsøgsv. PlKult.* no. 337. Copenhagen, 1940. (With a Summary in English.) [Recd. 1945.]

A detailed account is given of field experiments in Denmark in 1937–39 in which infusions of quassia chips were tested for the control of *Hoplocampa minuta*, Christ (*fulvicornis*, Panz.) on plum and compared with other insecticides. The egg, larva, adult and life-history of this sawfly are briefly described. Sprays were prepared by soaking 0·5, 1 or 3 lb. chips in 1 gal. water for about a day, boiling for one hour, straining, making up to 10 gals. and adding 0·5 per cent. soap just before spraying [*cf. R.A.E.*, A **27** 46], and it was found that one application of either of the weaker sprays was as effective as two of the strongest one, and that quassia sprays were superior to those containing cryolite and nicotine and soap, lead arsenate or derris powder. The chips were used a second time with little loss of effectiveness [*cf.* **27** 298]. Tests to ascertain the correct time for spraying showed that quassia was best applied at petal-fall, though effective applications were made at any time from full-bloom until a few days after petal-fall. Several proprietary preparations of quassia also gave good results against *H. minuta*, and the home-made sprays were effective in all tests except one against *Hyalopterus arundinis*, F. (*pruni*, F.) [*cf.* **27** 98; **31** 80].

Bovien (P.) & Stapel (C.). **Om Derris og nogle Forsøg med Derrispraeparater til Bekaempelse af Skadedyr.** [Derris and some Experiments with Preparations of it for the Control of Pests.]—*Tidsskr. Planteavl* **45** pp. 39–83, 11 figs., 13 refs. ; also as *Beretn. Forsøgsv. PlKult.* no. 339. Copenhagen, 1940. (With a Summary in English.) [Recd. 1945.]

The authors briefly review the nature and properties of insecticides prepared from derris root and give the results of numerous field and laboratory experiments in which various proprietary derris dusts, the composition of which is shown so far as it was known, were tested against many of the commoner pests of agricultural crops in Denmark. Those found highly susceptible were adults of *Meligethes aeneus*, F., and *Phyllotreta* spp. on rape, and *Byturus urbanus*, Lind. (*tomentosus*, auct.) on raspberry, and larvae of *Pieris brassicae*, L., on cabbage, and of the sawflies, *Nematus* (*Pteronus*) *ribesii*, Scop., on gooseberry, *Blennocampa geniculata*, Steph., on strawberry, *Caliroa* (*Eriocampoides*) *limacina*, Retz., on cherry, and *Athalia rosae*, L. (*spinarum*, F.) on radish. Adults of *Anthonomus rubi*, Hbst., *Anomala* (*Phyllopertha*) *horticola*, L., and *Phyllobius oblongus*, L., proved much less susceptible in the laboratory. In general, mortality was found to increase, though not proportionately, with the rotenone content of the dusts. Those containing 0·6–2 per cent. rotenone are considered the most suitable for general use, and the rates at which they should be applied against different pests are discussed. They were most effective at temperatures of 18–19°C. [64·4–66·2°F.] or above, but proved satisfactory at lower temperatures provided that higher ones followed within a few hours. The dusts can therefore be applied with advantage in the early morning, when the plants are wet with dew. They were ineffective against Aphids.

Plantesygdomme i Danmark (1939, 1941–43). Plant Diseases and Pests in Denmark (1939, 1941–43).—*Tidsskr. Planteavl* **45** pp. 193–258, 2 graphs, 2 figs. ; **47** pp. 189–271, 2 graphs, 4 figs. ; **48** pp. 1–90, 2 graphs, 2 figs. ; **49** pp. 1–72, 2 graphs, 1 fig. ; also as *Overs. Plantepat. Forsøg* nos. 56, 58–60. Copenhagen, 1940, 1942–44. (With Summaries in English.) [Recd. 1945.]

These reports contain sections in which P. Bovien surveys the principal pests of cultivated plants in Denmark in 1939 and 1941–43 as in other years [*cf. R.A.E.*, A **28** 6 ; **31** 81]. Unusual records in 1939 included one of injury to strawberry by *Galerucella tenella*, L., the larvae of which skeletonised the lower surfaces of the leaves and fed on the fruits in June. Pupation occurred in the soil, and adults emerged in the laboratory in mid-July. Larvae of *Phaedon armoraciae* var. *concinnus*, Steph., fed on the leaves of horse-radish in early September ; they also pupated in the soil, and gave rise to adults at the end of the month. Cauliflower heads were mined in October by larvae of *Scaptomyzella* (*Scaptomyza*) *incana*, Mg.

The pests recorded in 1941 included *Thrips angusticeps*, Uzel, on beet, chicory and sunflower, *Baris laticollis*, Marsh., the larvae of which bored in the roots and crowns of swedes, and *Galeruca* (*Adimonia*) *tanaceti*, L., which fed on the aerial parts of potato in June. The foliage of swedes and mustard was attacked in June by larvae of *Colaphellus* (*Colaphus*) *sophiae*, Schall., which had apparently migrated to these plants from wild crucifers. Some adults emerged in the laboratory and oviposited on leaves in early July, giving rise to a second generation, which, however, was not observed in the field. Many larvae of the first generation were attacked by parasites and fungous disease. Larvae of *Trachea atriplicis*, L., caused some damage to the leaves of rhubarb, and tomato leaves were mined by larvae of *Phytomyza* (*Liriomyza*) *solani*, Macq. *Eulecanium tuberculatum*, Targ., occurred on apple, and *Cydia* (*Laspeyresia*) *funebrana*, Treitschke, was common on cherry and also infested plum.

Those observed in 1942 included *Glischrochilus* (*Librodor*) *hortensis*, Geoffr., which injured the ripe fruits of strawberry and raspberry, *Cetonia aurata*, L., in the ears of rye, and *Xylena* (*Calocampa*) *exoleta*, L., on tobacco and poppy, while in 1943, cherry fruits were attacked by *Anthonomus rectirostris*, L., and seedlings of *Thuja occidentalis* by an unidentified species of *Isotomurus*, possibly *I. palustris*, Müll.

Bovien (P.). **Nøddesnudebillen.** [The Nut Weevil.]—*Gartner-Tidende* 1941 no. 36 repr. [2] pp., 2 figs. Copenhagen, 1941. [Recd. 1945.]

Observations in Denmark on the bionomics of *Curculio* (*Balaninus*) *nucum*, L., on hazel (*Corylus avellana*) showed that the adults emerged in different years between 5th and 20th June and fed for a short time on the young nuts, destroying many of them. The eggs were laid in the shell of the nut and were observed between 10th July and 20th August. The newly hatched larvae enter the nuts and feed on the kernel, and when they become full-fed in late summer, leave the nuts, whether these have fallen or are still on the bush, and overwinter in the soil. Larvae were found in nuts as late as September, and hibernating larvae were observed at depths as great as 8–12 ins. Pupation occurs in spring, but some larvae overwintered more than once. Although development is completed only on hazel, other fruits are sometimes attacked [*cf.* *R.A.E.*, A **17** 17; **31** 79], and in 1940 apples, pears and mirabelle plums that had been injured by the adults were received by the author. Eggs had been laid in some of the apples and hatched, but the larvae died in the second instar [*cf.* **31** 79]. Injury to other fruits occurs mostly in proximity to hazel or when the hazel crop is poor or unusually early.

Stapel (C.). **Om Halmhvepsens Skadelighed.** [The Injury due to *Cephus pygmaeus*.]—*Ugeskr. Landm.* 1942 repr. [2] pp. Copenhagen, 1942. [Recd. 1945.]

Injury to cereals by *Cephus pygmaeus*, L., has been increasing in Denmark of recent years. Notes are given on its life-history [*cf.* *R.A.E.*, A **30** 309], and it is pointed out that though infestation by the larvae does not reduce the amount of grain set, it prevents the full development of the grain. Wheat, barley and rye are attacked, and the percentage loss in weight of lots of 1,000 grains of wheat from infested stems averaged 19, as compared with grain from healthy stems. In further observations in four fields of wheat, the percentage of stems attacked averaged 15, and the loss in weight of grain from infested stems 20 per cent.

Jones (M. G.). **The Viburnum Aphis,** *Aphis* (*Doralis*) *viburni*, **Scop.**—*Bull. ent. Res.* **36** pt. 1 pp. 1–13, 6 figs., 18 refs. London, 1945.

The black Aphids found on the leaves of *Viburnum opulus* in England are *Aphis fabae*, Scop., *A. viburni*, Scop., and *Anuraphis* (*Ceruraphis*) *eriophori*, Wlk. Descriptions are given of the fundatrices of all three species, and the apterous and alate viviparae, oviparae, males and nymphs of *Aphis viburni* are also described and compared with those of *A. fabae*, body measurements being shown in tables. Oviparae of *A. viburni* deposit 1–4 winter eggs in the axils of the buds of *V. opulus* in autumn, and the young nymphs hatch towards the end of March and are found on the lower surface of the young leaves. The fundatrices mature in about three weeks in favourable weather. The early colonies are difficult to distinguish from those of *A. fabae*, and individuals of the two species may feed together on the same leaf. Alate viviparae of both appear in May and June, and colonies on *V. opulus* in or after mid-June are generally those of *A. viburni*, as the alate viviparae of *A. fabae* and *Anuraphis*

eriophori have flown to their summer food-plants. *Aphis viburni* breeds on *V. opulus* throughout the summer and autumn, and few alates are produced later in the year. Apterous males and oviparae appear in September. In the early autumn, both sexual forms and some apterous viviparae are produced by the same apterous parent, and the absence of alates in the autumn colonies distinguishes them from those of *A. fabae*, of which alate males and gynoparae return to *Viburnum* from summer food-plants.

In experiments in which viviparae of *A. viburni* were transferred to nine different summer food-plants of *A. fabae*, including broad bean (*Vicia faba*), which is the commonest of these in early summer, colonies matured and produced a second generation only on *Rumex obtusifolius* and *Euonymus europaeus*.

Webb (J. E.). **The Penetration of Derris through the Spiracles and Cuticle of** *Melophagus ovinus*, **L.**—*Bull. ent. Res.* **36** pt. 1 pp. 15–22, 1 fig., 3 charts, 16 refs. London, 1945.

It is shown from the experiments described, for which *Melophagus ovinus*, L., was chosen as an example of a sucking insect very susceptible to derris, that derris dust is absorbed through the spiracles and tracheal system, and that absorption through the cuticle occurs slowly at 30°C. [86°F.] and not at all at 20°C. [68°F.] [*cf. R.A.E.*, A **32** 419, etc.].

Golding (F. D.). **Notes on** *Helopeltis sanguineus*, **Popp., on Cotton in Nigeria.** —*Bull. ent. Res.* **36** pt. 1 pp. 75–78, 5 refs. London, 1945.

The author refers to taxonomic difficulties with regard to species of *Helopeltis* on cotton in Nigeria and cacao in the Gold Coast [*cf. R.A.E.*, A **29** 515–516] ; red and yellow individuals attacking cotton in Nigeria have both recently been identified as *H. sanguineus*, Popp., and were shown by breeding experiments in 1942 to belong to the same species. Lists are given of 12 plants on which this species was observed to breed and five on which adults were seen feeding. It appears to be extremely rare during May and June but adults become more numerous in July on *Spondias mombin*, and the first migrants appear on cotton in the first week of August, probably mainly from that plant. Some of the female migrants are gravid, the first nymphs appear on the cotton about a fortnight later, and adults and nymphs are abundant from mid-September until mid-December. After this, conditions are normally unfavourable, as the cotton plants are producing few new shoots and a dry wind is blowing, and nymphs are rare and adults rapidly decline in numbers. There appear to be three generations between early August and the middle of December. In February 1939, adults and one small nymph were found on a species of *Jussieua* (*Jussiaea*) growing on the bank of a river when nearly all the *Helopeltis* population had left a cotton field 400 yards away ; it was found that evaporation was 40 per cent. less near the river. In 1943, breeding on cotton ceased in early January and no nymphs were found during February and March, but adults were fairly numerous on young plants of *S. mombin* and *Paullinia pinnata* until early May, and a few nymphs were present during April. Almost all the breeding and feeding records for other plants were made during the cotton season, between late September and the middle of February.

There are considerable variations from season to season in the abundance of *Helopeltis* on cotton at Ibadan, but no correlation could be found between these variations and climatic conditions. Analysis of soil samples taken on each side of a number of cotton plants, some of which were severely and others lightly attacked, did not reveal any significant differences between the two groups. It was noticed that attack was particularly severe in a water-logged area and less severe on cotton following *Stizolobium* (*Mucuna*) *aterrimum* than on that following either maize or yams, both of which retard the growth of the cotton plants during the early part of the season.

Rivnay (E.). **Physiological and ecological Studies of the Species of *Capnodis* in Palestine (Col., Buprestidae). II. Studies on the Larvae.**—*Bull. ent. Res.* **36** pt. 1 pp. 103–119, 4 figs. London, 1945.

In this second part of a paper on the bionomics of Buprestids of the genus *Capnodis* that attack stone-fruit trees in Palestine [*cf. R.A.E.*, A **33** 75], the author describes the methods used for rearing the larvae in the laboratory, the appearance of the larva and its method of locomotion. He found that the tendency of the neonate larvae to burrow into the ground until they find the roots of a tree is governed by positive stereotactic and chemotropic reactions and not by phototropic or geotropic ones. They could detect roots or twigs from a distance of about 40 cm. and distinguish between the odour of various plants; stone fruits, and particularly almond and apricot, were the most attractive of the various fruit trees. The larvae fed by tearing off particles of the inner bark, from which they extracted the juice by chewing, finally discarding the remainder. The wood was softened by a fluid from the mouth; this fluid was shown to contain a cellulase, a pectinase and an amylase.

The rate of larval development depended on the quality of the food and on the temperature. It was retarded by dry or hard wood and accelerated by roots of loose tissue, such as apricot. The period from hatching to pupation lasted about 60 days at 33°C. [91·4°F.] and more than 100 days at 27°C. [80·6°F.]. Empirical data indicated that the threshold of development was about 18°C. [64·4°F.], and measurements and calculations according to Dyar's law that the larvae moult at least nine times before pupating. Neonate larvae survived for only a few hours in extreme drought, but some lived for 5–6 days at 26°C. [78·8°F.] and 80–90 per cent. humidity. Under conditions of excessive moisture they were long-lived, but inactive. At relative humidities of 65–90 per cent. and without food, all died in four days at 27°C., whereas 50 per cent. lived for more than ten days at 13°C. [55·4°F.]. When week-old larvae in wood were subjected to higher temperatures for 2, 4, 6 or 8 hours, about 75 and 50 per cent. survived at 46 and 50°C. [114·8 and 122°F.], respectively, for all exposure periods, but total mortality ensued when the larvae were exposed to the lower temperature for a few days.

Larvae will not leave infested root remains for new roots, as they lose the faculty of locating food by odour after the first instar, but since adults may emerge as much as two years after infested trees have been uprooted, a new plantation of stone fruits is liable to heavier infestation if planted on land from which infested trees have been removed. Mortality of larvae of all ages is greater in irrigated than in non-irrigated soil, and in vigorous trees than in weak ones, and certain varieties of stone-fruit trees are more resistant than others, probably because the injured cells secrete more gum, which drowns the larvae. It is therefore advisable to plant trees that are adapted to the local climate, to irrigate adequately and to plough and fertilise regularly in order to keep the trees vigorous. Trees on all root stocks become more infested with *Capnodis* shortly after they begin to bear fruit, and the variety of fruit that is grafted on the root stock has a distinct influence on the general welfare of the tree and consequently on its resistance to injury by *Capnodis*.

Ramchandra Rao (Y.) & Cherian (M. C.). **The Fluted Scale, *Icerya purchasi* Mask., as a Pest of Wattle in South India, and its Control by the biological Method.**—*Madras agric. J.* **32** nos. 3–7 repr. 20 pp., 3 figs., 4 refs. Madras, 1944.

Icerya purchasi, Mask., which was first reported on wattle (*Acacia*) in the Nilgiri hills in April 1928 [*R.A.E.*, A **18** 193], was again injurious there in 1941 and was also observed on wattle at various places in the Upper Palnis in 1941–42. It was probably introduced on imported orchard stock or flowering

plants from Ceylon, and its dispersal has been mainly along paths and roads, since the newly hatched nymphs are readily transported on the clothes of coolies or by cattle. Its present distribution is discussed, and lists are given of the plants on which it has been found in the Nilgiris and the Upper Palnis. The only ones of economic importance are the cultivated wattles, *Acacia decurrens*, *A. mollisoni* and *A. melanoxylon*, rose bushes and *Citrus*. Wattles grown on rocky areas or on shallow or gravelly soils are more severely infested than those growing on rich or deep soils, and new shoots springing up from coppices and root-suckers are seriously infested, whereas seedling plants are generally free from attack.

The newly hatched nymphs may cover some distance before fixing themselves on the twigs or leaves of suitable food-plants, where they feed until ready to moult. The female moults three times, and the feeding place appears to be changed after each moult. Males are very rare, and reproduction is apparently usually parthenogenetic. The duration of the life-cycle is dependent on temperature ; it lasted 46–93 days at Coimbatore during August–November 1928, 2½–3 months in the Nilgiris in the hot season and about two months longer in the colder parts of the year, and nearly eight months in the Upper Palnis in March–November 1943. However, there is a good deal of overlapping of generations in the field, and there are probably 2–3 generations in the year in the hills. *I. purchasi* flourishes best during the dry hot season, from mid-January to mid-June and in September–October, between the end of the south-west monsoon and the onset of the north-east monsoon, when the weather is usually warm in the hills ; during the monsoon rains, the young are sometimes washed away by the rain and the scales are infested by fungi, particularly in November–December.

Natural enemies found attacking the scale in the Nilgiris comprised the Coccinellid, *Rodolia fumida*, Muls. (*roseipennis*, Muls.), the Tineid, *Stathmopoda melanochra*, Meyr. [*cf.* **22** 235] and a fungus of the genus *Cladosporium*. The eggs of *R. fumida* and *S. melanochra* are deposited on the scale and on the egg-sac, respectively, and the larvae feed on the eggs within the sac. The egg, larval, prepupal and pupal stages of *R. fumida* and the complete developmental period lasted 6–26, 20–28, 7–13, 12–23 and 46–77 days, respectively, and the adults lived for 14–89 days. This Coccinellid has also been found in Ceylon and in other parts of South India, where it is apparently widely distributed. *S. melanochra* was probably accidentally introduced from Australia ; each larva destroys several egg-sacs, and the complete life-cycle lasts about 12–16 weeks. Observations in the infested areas showed that these natural enemies did not effectively control the pest, and the rainy season interfered with the cutting and burning of infested bushes, but *R. cardinalis*, Muls., which was introduced from California and Egypt and bred and liberated on the Nilgiris between August 1929 and October 1930, readily established itself, gave satisfactory control and was recorded from as far as seven miles from the points of liberation. When the scale reappeared, breeding of the predator was resumed, and 5,817 adults were liberated on the Upper Palnis between October 1942 and October 1943. From experience in other countries, it was thought that the Coccinellid would sooner or later re-assert itself on the Nilgiris, but further liberations were made there to hasten the process.

In the course of breeding *R. cardinalis* it was observed that mating and oviposition occurred soon after emergence in warm bright weather, but that the beetles were inactive when it was dull and cold. The eggs were deposited singly, usually on the egg-sac of mature scales, but sometimes on nymphs or even on bare twigs, and hatched in 6-12 days. The newly hatched larvae devour young scales, older ones feed on larger nymphs and the beetles attack the egg-sacs and both nymphs and mature scales. The larval, prepupal and pupal stages lasted 13-24, 3-9 and 5–15 days, respectively, and the complete life-cycle 30-70 days ; 51 females laid an average of 217 eggs each. Males and females lived for

averages of 57 and 59·7 days when allowed to feed and pair, 16·5 and 9 days when allowed to pair but not to feed, and 21·3 and 19·75 days when allowed to do neither. Eight generations were produced in a year under laboratory conditions both on the Nilgiris and on the Upper Palnis.

RAMAKRISHNA AYYAR (T. V.). **Notes on some Fruit-sucking Moths of the Deccan.**—*Indian J. Ent.* **5** pt. 1–2 pp. 29–33. New Delhi, 1944.

The author discusses the injury due to fruit-piercing moths in various parts of the tropics, with particular reference to India [*cf. R.A.E.*, A **12** 378 ; **13** 10 ; **26** 409, etc.] and gives a list of 14 species that have been identified among material recently taken chiefly by traps and lights in orchards in the Deccan, where these moths cause serious injury to *Citrus* and some damage to guava. The appearance of the adult is very briefly described in each case, and short notes on the bionomics and appearance of the immature stages are given in some. The most important species are *Othreis fullonia*, Cl. (*Ophideres fullonica*, L.), *O.* (*O.*) *materna*, L., *O.* (*O.*) *ancilla*, Cram., and *Calpe emarginata*, F. The egg, larval and pupal stages of *O. materna*, which breeds on the wild creeper, *Tinospora*, last 8–10 days, 4–5 weeks and 14–18 days, respectively. Adults of *Anua coronata*, F., which is fairly common, were also present and are believed to cause some damage. The eggs are laid singly on the young leaves of *Quisqualis*, and this garden plant is often defoliated by the larvae. Pupation occurs on the ground within a cocoon constructed in a rolled-up leaf, and the adult emerges in 10–12 days. *Serrodes partita*, F. (*inara*, Cram.) and *Sphingomorpha chlorea*, Cram., which have been recorded as piercing fruits in Southern Rhodesia [**11** 238], were taken on some occasions. Larvae of the former attack *Sapindus* throughout the Deccan in August-October, the eggs being laid singly on the leaves. Pupation occurs within a rolled-up leaf, and the adult emerges in about three weeks. *Achaea janata*, L., which is an important pest of castor [*Ricinus communis*] in the Deccan, and *Parallelia algira*, L., which also breeds on this plant, were fairly numerous, but their importance as fruit-sucking moths is not known. The eggs of *A. janata* are parasitised by a Chalcidoid and the larvae by the Braconid, *Microplitis maculipennis*, Szép. (*ophiusae*, Ram. Ayyar).

MATHUR (C. B.). **The Site of the Absorption of Water by the Egg of the Desert Locust** (*Schistocerca gregaria* **Forskål**).—*Indian J. Ent.* **5** pt. 1–2 pp. 35–40, 2 figs., 4 refs. New Delhi, 1944.

Since the development of the eggs of *Schistocerca gregaria*, Forsk., is retarded or suspended in soil of low moisture content, indicating that the absorption of water is essential for its continuance [*cf. R.A.E.*, A **29** 342–343], laboratory experiments, which are described, were carried out in Baluchistan to determine the site of absorption in the egg. It was found that water enters only through a specialised region situated at the extreme posterior end. This region is functional almost from the time of deposition, but probably exists then only as a permeable membrane, later becoming more elaborate in structure. It corresponds in position with the specialised region (hydropyle) described by E. H. Slifer for the egg of *Melanoplus differentialis*, Thos., which, however, in experiments at 25°C. [77°F.], did not become functional until development had proceeded for six days.

MOHAMMAD AFZAL & MANZOOR ABBAS. **Cotton Jassid** (*E. devastans* **Dist.**) **in the Punjab. V. A Note on the Characters of the Plant associated with Jassid Resistance.**—*Indian J. Ent.* **5** pt. 1–2 pp. 41–51, 15 refs. New Delhi, 1944.

American varieties of cotton introduced into India are highly susceptible to attack by *Empoasca devastans*, Dist., and in view of the unsatisfactory

control of this Jassid given by insecticides and the absence of effective natural enemies, the development of resistant varieties of cotton appears to be the only method available to reduce loss. Hairiness of the leaves has been regarded as an indication of resistance, but recent work has cast some doubt on its reliability as a criterion, and evidence is accumulating that hairiness is not itself the resistant factor [*cf. R.A.E.*, A **29** 517 ; **33** 362]. It was concluded from previous investigations that the toughness of the cuticle of the leaf veins, which prevented the entry of the ovipositor, was the primary character rendering plants resistant, since once the eggs were laid in the leaf-veins of even such immune varieties as desi cotton (*Gossypium arboreum*) they hatched and the nymphs developed normally. Measurement of toughness proved difficult, however, and experiments, which are described, were therefore carried out on the value of other characters, such as the moisture content of the leaf veins, which varied with rainfall or irrigation, the pH value of the cell sap, which was not associated with resistance, the thickness of the cuticle of the leaf-veins, which did not differ in susceptible and resistant varieties, and the hairiness of the leaf-veins. This last character showed a close correlation with resistance, and it was also found that the density of the hairs was highly correlated with their length. In the experiments with hybrids, the density of the hairs on resistant plants varied over a very narrow range about a mean of 127·5 per cm. and tended to lie towards the upper limit. The mean number of hairs per cm. on susceptible plants was 34·31, but the density varied over a considerable range, and it is therefore desirable in breeding for resistance to select only the very hairiest plants.

Padmanabha Aiyar (K. S.). **On three Caterpillars destructive to Mango Flowers.**—*Indian J. Ent.* **5** pt. 1–2 pp. 53–57, 11 figs. New Delhi, 1944.

Notes are given on the bionomics of *Eublemma angulifera*, Moore, an undetermined Geometrid of the genus *Chloroclystis* and *Argyroploce aprobola*, Meyr., all of which were observed damaging the flowers of mango in Travancore in 1942, together with brief descriptions of all stages of the first two. Larvae of *E. angulifera* were numerous on grafted trees at two places early in the flowering season, and two later infestations occurred in orchards where some of the finest varieties are grown. The eggs of this Noctuid are deposited singly on the pedicels and sepals of the flower buds. The larvae feed on the sepals for three or four days after hatching and then spin webs and feed beneath them on the buds and flowers for about five days ; after this they attack the branches of the inflorescence, each protected by a silken shelter covered with frass, which is extended as fresh parts are attacked. Pupation occurs in a cocoon at or near the base of the inflorescence. The larval and pupal stages last 16–18 and 13 days, respectively.

Larvae of *Chloroclystis* were first observed on mango in November, when they infested almost all the panicles of all varieties in flower at the time. They were later observed at three other places and are considered a pest of major importance. The eggs are laid singly or in groups on the flower buds ; the larvae enter the buds and feed on the ovaries and also attack the ovaries of newly-opened flowers. The larval and pupal stages last about 10 and 7–8 days, respectively. Large numbers of larvae of *A. aprobola*, a Tortricid that also damages the young shoots of *Eugenia cumini* (*jambolana*) in Travancore, were observed in November webbing the young leaves and boring into the shoots of mango in two districts. They web together adjacent buds and flowers and feed chiefly on the epidermis of the branches of the panicle and of the pedicels.

Bose (M.). **Bionomics and Life-history of** *Myllocerus laetivirens* **Marshall (Otiorrhynchinae : Curculionidae).**—*Indian J. Ent.* **5** pt. 1–2 pp. 103–105. New Delhi, 1944.

An account is given of investigations on the bionomics of *Myllocerus laetivirens*, Mshl., in Delhi [*R.A.E.*, A **30** 58], where the adults have caused injury to the leaves of cotton and various fruit trees in recent years, together with brief descriptions of the immature stages. The adults have been found to attack 17 species of plants, a list of which is given, but appear to prefer almond, plum and *Schinus terebinthefolius*. They consume the young leaves and then skeletonise the older ones, except in the case of cotton, on which irregular holes are eaten in the leaves. The egg, larval and pupal stages are stated to last about 4–5 days, 10 months and 5 days, respectively, and the adults, which are most abundant in August, survive for 2–3 months. Owing to its polyphagous habits, the economic importance of this weevil is likely to increase with the increase of fruit culture. Hand-collection of the adults is of value as a control measure in small orchards, and arsenical sprays gave satisfactory results in preliminary trials.

Afzal Husain (M.) & Mathur (C. B.). **Studies in** *Schistocerca gregaria* **Forsk. XI. The Influence of Temperature on the Growth in Weight and Size of the Hoppers.**—*Indian J. Ent.* **5** pt. 1–2 pp. 107–115, 1 graph, 14 refs. New Delhi, 1944.

Comparative studies in India on hoppers of *Schistocerca gregaria*, Forsk., reared at constant temperatures of 27, 32, 37 and 40°C. [80·6, 89·6, 98·6 and 104°F.] showed that the increase in their weight during each instar and during total development varies inversely with the temperature in both sexes. The influence of temperature on size was studied with hoppers reared at 40 and 27°C. Those reared at 27° were the larger, and there was a progressive increase in the difference in the size of various parts of the body in each instar. Four biometrical ratios calculated for the adults were found to differ at the two temperatures. The E/F ratios of those reared at 27 and 40° conformed, respectively, with those stated by Ramchandra Rao [*cf. R.A.E.*, A **31** 156] to be characteristic of phases *solitaria* and *transiens*. All the newly hatched hoppers showed coloration typical of phase *transiens*, they were isolated throughout their development, and the resulting adults all had coloration typical of phase *solitaria*. The observed differences in the biometrical ratios were therefore not due to phase transformation, but were related to differences in size due solely to temperature, and it is suggested that the difference in biometrical ratios between the phases merely reflect the difference in size of the locusts belonging to them.

Mathur (R. N.). **Bamboo Defoliators.**—*Indian J. Ent.* **5** pt. 1–2 pp. 117–128, 21 refs. New Delhi, 1944.

A list is given of 18 Lepidoptera and three other insects that feed on the leaves of bamboos of various kinds in India, compiled from official records, with brief notes on the appearance of the various stages, distribution and bionomics of some of them and an account of observations on *Pyrausta coclesalis*, Wlk., which is one of the more injurious of the Lepidoptera. This Pyralid is widely distributed in India where its chief food-plants are species of *Dendrocalamus* and *Bambusa*, and it has also been recorded on bamboo and sugar-cane in Java and sugar-cane in Tonkin. It defoliated *Cephalostachyum pergracile* in Burma in 1939. The larvae skeletonise the young leaves and later web or roll the leaves together and feed within the shelters thus formed. Each larva may make several such rolls. There were four generations a year in the laboratory at Dehra Dun in 1931–32 ; the winter is passed by the full-fed larvae in cocoons in rolled leaves, in holes in the culms or in the soil. The adults

are nocturnal, and those of the overwintered generation emerged from late May until June or July, corresponding with the period when the new leaves of bamboo are being produced. The eggs were usually laid in masses of 8–23 on the leaves ; the maximum number of eggs in a mass was 60, and one female deposited 687 eggs in 38 masses. The egg, larval and pupal stages, which are described, lasted 2–4, 18–36 and 7–12 days, respectively, in summer, and the larvae were most numerous in July–September, when all stages occur together. Almost all the larvae had entered hibernation by mid-November. In the Punjab the larvae defoliated bamboo as early as May in 1938, and in Coorg they were observed feeding during November and December in 1941, and evidently entered hibernation in January. During wet weather and in cages in which humidity was high, many were killed by a fungus. Lists are given of about 20 parasites reared from *P. coclesalis* and six predators that attack it, with notes on the bionomics of some of them ; a species of *Chelonus* and *Microgaster kuchingensis*, Wlkn., appear to be the most important. *Trichogramma minutum*, Ril., readily parasitised the eggs in tests in August 1943, and one or two adults emerged from each.

The insects other than Lepidoptera are the Hispid, *Estigmena chinensis*, Hope, of which the larvae bore in the culms of bamboo and the adults feed on the tips of the shoots and the young leaves, and the Acridids, *Poekilocerus* (*Poecilocerus*) *pictus*, F., and *Hieroglyphus banian*, F., which caused considerable injury in a forest area in the Punjab in 1923 and 1934, respectively.

KAPUR (A. P.). **On the Biology and the Structure of the Coccinellid** *Thea bisoctonotata* **Muls. in north India.**—*Indian J. Ent.* **5** pt. 1–2 pp. 165–171, 15 figs., 16 refs. New Delhi, 1944.

Coccinellids of the tribe PSYLLOBORINI feed on lower fungi and the mouth-parts of the larvae and adults are specially modified for this purpose. Of the eight species recorded from India, *Thea bisoctonotata*, Muls., and *Halyzia sanscrita*, Muls., are the commonest in the north, where they have been reported to feed on the epidermis of leaves of *Dalbergia sissoo*, and *Illeis cincta*, F., is common in the centre and south and has been recorded as attacking mites, Aphids, Coccids and fungi. Although these beetles are not generally regarded as of economic importance, the author considers them capable of transporting the spores of injurious fungi on their legs. He describes all stages of *T. bisoctonotata*, gives a table showing the differences in the mouth-parts of adults of fungivorous, carnivorous and herbivorous Coccinellids based partly, as regards the fungivorous species, on studies of *T. bisoctonotata*, *H. sanscrita* and a species of *Halyzia* found on leaves of pear infested with mildew in Kashmir, and discusses the reasons for the modifications. Various stages of *T. bisoctonotata* and *H. sanscrita* were observed on many occasions over a period of five years on leaves of *D. sissoo* that were severely infested with mildew. In the laboratory, both adults and larvae fed only on leaves infested with fungi, and the latter appear to be essential to their development. Under insectary conditions in March–April, a generation of *T. bisoctonotata* lasted 30–39 days at an average temperature of 29·6°C. [85·28°F.]. Mass hibernation of this Coccinellid was recorded for the first time from India in the winter of 1936, when the beetles were found congregated on the lower surface of the leaves of two trees of *Bauhinia purpurea* in Lahore. They dispersed early in March.

MUZZAFER AHMAD. **The Morphology and Biology of** *Rhogas testaceus* **(Spin.) a Braconid internal Parasite of Spotted Bollworms of Cotton.**—*Indian J. Ent.* **5** pt. 1–2 pp. 189–205, 30 figs., 14 refs. New Delhi, 1944.

An account is given of the bionomics of *Rogas testaceus*, Spin., which parasitises the larvae of *Earias insulana*, Boisd., and *E. fabia*, Stoll, on cotton in

northern India, together with descriptions of all stages, the anatomy of the fully grown larva and the process of development within the host. The most important factor influencing development, survival and oviposition was found to be temperature. Development of the females lasted 10–11 days in summer and 30–35 in winter, and that of the males rather less. The average durations of development, and of adult life when fed, of females reared in the laboratory ranged from 44 and 37 days, respectively, at 15°C. [59°F.], to 10·4 and 4 days at 35°C. [95°F.]. The maximum number of eggs deposited by a single female at the optimum temperature of 25°C. [77°F.] was only 83. Unfertilised females gave rise to males only. It was found that up to four eggs may be laid in individual hosts but that only one of the resulting larvae can complete its development. It is concluded from observations in 1942 that the parasite is probably present in the field throughout the year, though it was not taken in all months. It was most active in November and was recorded at various times from *Earias* on cotton, *Hibiscus esculentus* and hollyhock.

R. testaceus has been recorded from various Lepidoptera in Europe, but attempts to induce it to oviposit in larvae of *Platyedra gossypiella*, Saund., and *Corcyra cephalonica*, Staint., in the laboratory in India were unsuccessful. Although it breeds throughout the year and develops quickly, it does not appear to afford much control of *Earias*, and this is attributed to high mortality among the pupae, which reached 25 per cent. in field-collected material, and the common occurrence of superparasitism. Its low fecundity and the absence of suitable alternate hosts renders mass-breeding in the laboratory difficult.

CHATTERJEE (P. N.). **Description of *Rhogas plecopterae* sp. nov. from India with Notes on its Biology and Morphology.**—*Indian J. Ent.* **5** pt. 1–2 pp. 213–221, 11 figs., 7 refs. New Delhi, 1944.

Descriptions are given of the adults of both sexes and immature stages of *Rogas plecopterae*, sp. n., which was reared from larvae of *Plecoptera reflexa*, Gn., on *Dalbergia sissoo* at Allahabad and Dehra Dun, together with characters distinguishing it from other species of its genus. In the laboratory, the females fed on a solution of sugar and honey and also on the body-fluid of the host at the oviposition punctures. At Allahabad, they survived for 20 days under laboratory conditions in March, and a male and a female survived for 44 and 55 days, respectively, in an ice-cooled flask. A fertilised female that had emerged on 11th March 1939 and died on 22nd March deposited a total of 13 eggs on six days. The duration of the combined egg and larval stages, the pupal stage and complete development in March–April lasted 7–13, 6–10 and 13–20 days, respectively.

The parasite attacks host larvae in any of the first four instars, the most favourable being the third. The egg hatches in 48 hours, and the larva feeds within the body of the host, which ceases to feed six days after being attacked, turns yellow, and becomes sluggish. Superparasitism occurred occasionally in the laboratory. Two undetermined Chalcidoids and a Eulophid of the genus *Tetrastichus* were reared from cocoons of *R. plecopterae* ; they were all solitary parasites, and emerged 11-12 days after *Rogas* had formed its cocoons.

Short Notes and Exhibits.—*Indian J. Ent.* **5** pt. 1–2 pp. 243–249. New Delhi, 1944.

S. Pradhan (pp. 244–245) describes a method for assessing adult populations of *Pyrilla* on sugar-cane in India by catches in fields in which marked individuals have been released as has been done in the case of tsetse flies [*cf.* *R.A.E.*, B **22** 12 ; **29** 123, etc.]. Marking individual adults with enamel paint was more satisfactory than spraying batches with eosin solution, which caused high mortality ; Indian ink appears still more promising, since it dries

quickly. The number that should be released per acre in order to give reliable results has not yet been determined; in trials, numbers up to 400 per ¼-acre were too small.

H. S. Pruthi (pp. 245–246) reports that *Quadraspidiotus perniciosus*, Comst., which was thought to be absent from South India, was found in October 1943 on apple, pear and plum in several widely-separated districts in the Nilgiris, where it had evidently been present for some years and had been distributed with nursery stock. In November, it was also discovered on apple and plum in the Salem District, where it appeared to be well-established.

V. Prabhaker Rao (pp. 246–247) states that in view of the increased cultivation of wattle (*Acacia*) in Madras and Mysore, a survey of the whole of the Indian Peninsula was begun in September 1943 to ascertain the distribution of *Icerya purchasi*, Mask., which is an important pest of this and many other plants, but had so far been recorded only from certain districts in Madras. Preliminary observations showed that it had spread not only beyond these districts, but also into Mysore and Travancore. It occurred on *Acacia* spp. in practically all the places in which it was found, and was also observed on numerous other plants, lists of which are given for each area. The author points out that the quarantine regulations made in Madras in November 1943 are of little value, since the Coccid is already present outside the area covered by them.

K. R. Sontakay (pp. 247–248) gives notes on the bionomics of *Othreis materna*, L., and *O. fullonia*, Cl. (*fullonica*, L.) in the Central Provinces and Berar, where these moths cause considerable loss by piercing orange fruits. They are injurious from July, when the first-formed fruits are fairly large, until October and sometimes cause a reduction of 30–40 per cent. in the first of the two crops of oranges. The moths were first seen at light at the end of June and the first eggs were observed on *Tinospora cordifolia* at the beginning of July. In both species, the egg, larval and pupal stages lasted about 3–4, 13–15 and 8–10 days, respectively. The larvae were present on *T. cordifolia* until the middle of October, after which no stages of either species could be found until the following June. About 30 per cent. of the eggs were parasitised by a Chalcidoid.

M. S. Anwar (pp. 248–249) describes the natural control by parasites of an outbreak of *Asamangulia cuspidata*, Mlk., on sugar-cane in Delhi in 1939 [A **30** 318]. Larvae of this Hispid mine the leaves of the young plants between June and September and occasionally cause considerable damage. About the beginning of July, when some 30 per cent. of the leaves were infested, an ectoparasite of the genus *Bracon* (*Microbracon*) attacked the larvae, and 38 per cent. were parasitised by it in the first week of August. Owing to the rapid multiplication of the host, however, little control resulted. Another ectoparasite, *Elasmus* sp., appeared later but the percentage parasitism by it decreased from 6 to 1 per cent. within three weeks. By the first week of September, however, when parasitism by *Bracon* had fallen to 4 per cent., 60 per cent. of the larvae were attacked by an endoparasite of the genus *Closterocerus*, and parasitism of the pupae by a Chalcidoid had increased from 17 to 36 per cent. within a fortnight. No eggs of the Hispid were observed after this date, and superparasitism occurred owing to the scarcity of host larvae.

TREHAN (K. N.). **Further Notes on the Bionomics of *Bemisia gossypiperda* M. & L., the White-fly of Cotton in the Punjab.**—*Indian J. agric. Sci.* **14** pt. 1 pp. 53–63, 4 graphs, 12 refs. Delhi, 1944.

The author gives additional information on the bionomics of *Bemisia tabaci*, Gennadius (*gossypiperda*, Misra & Lamba) on cotton in the Punjab [*cf. R.A.E.*,

A **25** 44], obtained in the course of investigations carried out at Lyallpur in 1931–36.

Of about 8,000 adults collected in March–May, only 22 per cent. were males, indicating that excessive parthenogenesis during that period may be due to the excess of females. As the use of coloured traps for Aleurodids has been suggested, the attractiveness of various colours for the adults was tested by counting the numbers caught in cages on glass tubes filled with coloured liquid and coated with a transparent adhesive. Yellow and yellow-green were equally attractive and much more so than other colours, while orange, blood red and blue were more attractive than no colour (water), bright red, orange-red or purple. The adults are probably carried long distances by wind ; uninfested seedlings, planted on roofs 40 ft. high and 150 yards from the nearest cotton field became infested in a few days. On plants caged with newly emerged adults, 51·5 per cent. of the total eggs were laid on the top leaves, 46·7 on the middle ones and only 1·8 per cent. on the bottom ones, and the preference for the top of the plant was confirmed by field observations. In nature, the eggs are deposited on the lower surface of the leaves, and in cages about 80 per cent. were laid on the natural lower surface even if it was turned upwards. When batches of females were kept at different temperatures, no eggs were laid at 19°C. [66·2°F.], and of the total number, 0·2, 3·8, 9·6 and 14·3 per cent. were laid at 21, 24, 27 and 30°C. [69·8, 75·2, 80·6 and 86°F.], and 24·3, 24·1 and 23·6 per cent. at 33, 35 and 37°C. [91·4, 95 and 98·6°F.]. This preference for the temperatures above 33°C. explains the active multiplication during May–September, when the average maximum temperature ranges from 33 to 41°C. [105·8°F.].

Observations on varietal susceptibility of cotton to infestation by *Bemisia* included investigations of the pH value [**24** 763] and the moisture content of the leaves. There was no strict relationship between the percentage of moisture in the leaves and attack, but the variety with the lowest percentage of moisture was heavily infested. Tests to determine the relation between the amount of water applied to the crop and incidence of attack, in which plots received 3–10 irrigations, showed that those that received the largest number had the lowest average infestation, whereas plots that received restricted irrigation were comparatively severely infested ; it is concluded that 6–7 irrigations are needed to affect infestation significantly. In a test made in 1934, cotton in alternate plots was sown in lines or in pits 5 ft. apart, filled with farmyard manure. The plants grown in the pits, each of which had only one, were very bushy and were less infested than the others.

Uppal (B. N.), Verma (P. M.) & Capoor (S. P.). **A mosaic Disease of Cardamom.**—*Curr. Sci.* **14** no. 8 pp. 208–209, 3 refs. Bangalore, 1945.

A mosaic disease of cardamom (*Elettaria cardamomum*) is widely distributed in Travancore and Mysore and very injurious in North Kanara (Bombay) where it renders the plantings commercially useless in a few years. Experiments on its transmission were carried out in insect-proof greenhouses. Sap inoculation gave negative results, and no infection resulted from planting healthy stocks in contaminated soil. In tests with insects common on cardamom in North Kanara, the disease was not transmitted by *Taeniothrips cardamomi*, Ram. Ayyar [*cf. R.A.E.*, A **30** 559], two Jassids or two Aleurodids, but was transmitted by an Aphid, probably *Pentalonia nigronervosa*, Coq., appearing 21–46 days after the Aphids were transferred to the previously uninfected plants. This Aphid breeds on the stems beneath loose leaf-stalks and on banana plants ; it was found in large colonies on decaying cardamom plants.

Prabhaskumar Mitra. **The Moth *Taragama siva* Lefroy, as a Pest of Guava Tree (*Psidium guava*).**—*Curr. Sci.* **14** no. 8 p. 209, 1 fig., 3 refs. Bangalore, 1945.

Larvae of the Lasiocampid, *Taragama siva*, Lefroy, which are known to infest *Acacia arabica*, *Zizyphus jujuba* and rose in India, were observed on a guava tree growing near rose bushes in Calcutta in July 1944. They had disappeared by the end of the month, but others appeared on the same tree in January and February 1945. The larvae pupated in cocoons on the tree, and the pupal stage lasted 12–20 days. Other guava trees in the neighbourhood were not infested.

Trehan (K. N.) & Rajarao (S. A.). **A Note on the predatory Habit of *Tribolium* Beetles.**—*Curr. Sci.* **14** no. 8 pp. 209–210. Bangalore, 1945.

To obtain eggs for use as host material in the mass rearing of *Trichogramma minutum*, Ril., in Bombay, *Corcyra cephalonica*, Staint., is reared in broken sorghum. The sorghum is often infested by *Tribolium*, and though this was at first thought to be of no importance, it was subsequently found that most of the eggs of the moth in infested grain are destroyed by the beetles. An account is given of experiments in which known numbers of *Tribolium* and eggs of *Corcyra* were placed in jars of broken sorghum, and the eggs were counted and replaced at intervals of 24 hours. In all, 4,050 eggs were exposed to 84 beetles ; 93·4 per cent. were eaten in the first 24 hours and many of the remainder in the next 48 hours. Other observations showed that the beetles do not feed on larvae of *Corcyra*. Beetles in the grain can be destroyed by exposure to a temperature of 60°C. [140°F.], but, as reinfestation is possible, it is suggested that the cultures should be started by introducing larvae of *Corcyra* instead of eggs.

Gough (H. C.). **A Review of the Literature on Soil Insecticides.**—7×9 ins., iii+161 pp., 17 pp. refs. London, Imp. Inst. Ent., 1945. Price 10*s*.

This work is based largely on papers noticed in the first 28 volumes of this *Review*, though some published after 1940 are also included. A short general section deals with methods of application, the distribution of insecticides in the soil, experimental methods of assessing their toxicity to insects, and their effect on plants and micro-organisms. A separate section is devoted to each of the nine principal soil insecticides, and the numerous other materials that have been tested for this purpose are reviewed in alphabetical order in a concluding section. The kinds of insects against which the material is used, the results obtained with it by various authors, and the methods of applying it to the soil are dealt with in each case. Conversion tables and tables showing the comparative toxicities of various chemicals to wireworms (*Agriotes* spp.) and larvae of *Popillia japonica*, Newm., are given in two appendices.

Arthur (D. R.). **A Note on two Braconids (Hym.) in their Control of Corn Aphides (Hem.).**—*Ent. mon. Mag.* **81** pp. 43–45, 3 refs. London, 1945.

In the course of investigations in South Wales in 1942–44, large numbers of Aphids were found infesting cereals throughout the area, particularly in fields that had been treated continuously with farmyard manure. *Macrosiphum avenae*, F. (*granarium*, Kby.) was abundant, and *Rhopalosiphum prunifoliae*, Fitch (*Aphis avenae*, auct.) and *M.* (*Myzus*) *festucae*, Theo., were present in

smaller numbers. All three species first appeared in March and April, when plant tissues were fresh and succulent, and became particularly abundant in the middle of May. Of the principal predators in the ten fields investigated, *Adalia bipunctata*, L., and *Coccinella septempunctata*, L., were dominant, with some Syrphids and other less important Diptera, but the most important factors in the biological control of the Aphids were the parasites *Aphidius avenae*, Hal., and *A. granarius*, Marsh. Both Braconids attacked all stages of the Aphids under laboratory conditions, but preferred the second and subsequent instars in nature. Generally one egg was deposited in the body of the host, but individuals sometimes received several [*cf. R.A.E.*, A **11** 338], and as many as 6–8 larvae in different stages were found in a single host, though only one reaches maturity [**28** 637]. When meteorological conditions were such that little or no flight of the host or parasite was undertaken, both were confined to the lower surface of the leaves; such conditions were probably conducive to the mating of the parasites and to successful parasitism.

In view of the high degree of parasitism observed, a quantitative study of the changes in the populations of the Aphids in relation to this factor was undertaken. In the field, *A. granarius* first appeared in early April, and was generally more prevalent when rainy spells were interspersed with dry weather and a fair quantity of sunshine; *A. avenae* was more abundant towards the middle of April. Both species then increased until parasitism by *A. granarius* reached a peak during the last week in May, and parasitism by *A. avenae* 7–10 days later. The percentages of Aphids parasitised at different places were 13–24 in early April, 21–40 in mid-April, 63–75 in late May and 59–81 in early June. They then decreased gradually, and the number of Aphids in the field in late July and early August was negligible. Reference is made to Ullyett's calculation to explain the fact that the two Braconids were unable to exercise maximum control until the Aphids had passed through several generations and caused some crop damage [**28** 637].

To determine the susceptibility of alates and apterae of each of the three Aphids to each of the two parasites, three fertilised females of the latter were introduced into cages containing 50 Aphids, free from parasitism, on growing oat plants. Examination of the cages 12 days later showed that alates were less susceptible to parasitism than apterae and that *A. avenae* was more successful than *A. granarius* in parasitising apterae of *Macrosiphum festucae*, but that there was no other difference in the relative efficiency of the parasites.

Bovey (P.). **La teigne des fleurs du pommier, *Argyresthia cornella* F. (Lép. Hyponomeutidae), important ravageur des vergers valaisans.**—*Verh. schweiz. naturf. Ges.* **122** pp. 137–138. Aarau, 1942. [Recd. 1945.]

Damage to apple buds in the Swiss plateau and in central Valais is usually attributed to *Operophtera brumata*, L., and the Tortricids, *Spilonota* (*Tmetocera*) *ocellana*, Schiff., and *Argyroploce variegana*, Hb., but recent observations have shown that *Argyresthia cornella*, F., and *Chloroclystis rectangulata*, L., are also involved [*cf. R.A.E.*, A **33** 125]. *A. cornella* occurs throughout the apple-growing regions of Switzerland and has been found in Valais at altitudes up to about 4,000 ft. The adults of this Tineid appear in late May or early June and are present for 4–6 weeks. The eggs are laid under the old bud scales, in cracks in branches or under the bark; they overwinter, and the larvae hatch in early April, enter the flower buds, and become full-fed at the beginning of the flowering season and pupate immediately below the surface of the soil. The adults emerge a month later. In neglected orchards near Sion 35 per cent. (in some cases over 50 per cent.) of the Lepidopterous larvae in apple buds in 1941 and 1942 were *A. cornella*, the others comprising *C. rectangulata*, Tortricids and *O. brumata*. *A. andereggiella*, Dup., also infests apple buds in Valais, but is not common enough to be of economic importance.

Baker (A. C.), Stone (W. E.), Plummer (C. C.) & McPhail (M.). **A Review of Studies on the Mexican Fruitfly and related Mexican Species.**—*Misc. Publ. U.S. Dep. Agric.* no. 531, 155 pp., 10 pls., 82 figs., 49 refs. Washington, D.C., 1944.

The following is taken from the authors' summary. *Anastrepha ludens*, Lw., is widely distributed in Mexico, where it attacks mango, *Citrus* and other fruits [*cf. R.A.E.*, A **33** 52]. Studies have confirmed field infestation of *Annona cherimolia, A. reticulata, Casimiroa edulis, Eugenia jambos, Inga jinicuil, Mammea americana*, peach, guava, pomegranate, pear, apple, quince and *Sargentia greggii*. Lists are given of other fruits and vegetables infested under laboratory conditions and fruits that were not infested in the laboratory.

Grapefruit is evidently preferred to orange for oviposition, but heavy infestation may depend on factors other than fruit preference. Mango is decidedly preferred to guava, and green to ripe fruit ; as many as 117 larvae have been found in a single mango. The selection of fruit for adult feeding is less specific than for oviposition. Old shaded *Citrus* groves offer an environment very suitable to the fly, although fruit on small trees growing in open areas does not escape infestation. In Cuernavaca, mangos are almost continuously available, and sweet lime, which is a minor food-plant there, and off-season mangos maintain the fly population throughout the year. After the mangos have fallen from the trees, the flies migrate to guava in fruit, although the females seldom oviposit in guavas. In Tequila, the populations in *Citrus* groves are high because of the earlier infestation in mangos. In Tampico, the sequence of *Citrus* maturing throughout the year evidently maintains the fly. Recent studies in Santa Engracia indicate that the fly populations that enter *Citrus* groves in the autumn are apparently produced in *S. greggii* in the summer [*cf.* **30** 274]. In this district, the flies leave the groves in spring even though fruit remains. The migration of flies to and from groves in Texas is discussed. All the data indicate that the fruit-fly cannot be eliminated during the off-season summer months, since populations are widely dispersed throughout its native habitat, but the maintenance of a period in summer during which no fruit known to be attacked is allowed to reach the susceptible stage is of value in Texas in preventing the increase of the fly shortly before the early varieties of *Citrus* mature.

The egg stage lasted 5·5–12 days under natural variations of temperature in Cuernavaca, and the larval stage lasted 18·5–35 days at a mean temperature of 70·52°F. The time spent in the fruit ranged from 15 days in figs to 32 in mandarins at a constant temperature of 77°F. There appears to be no relation between the length of the larval period and the pH value of the fruit. In peppers [*Capsicum*], the shortest larval periods were 54·25 days at 59°, 25·5 at 68°, 16·5 at 77° and 14 at 86°F. *Opius crawfordi*, Vier., is the commonest parasite of the larvae of *A. ludens* in Mexico, but the percentage parasitism is relatively low. Predators, including the Staphylinid, *Philothalpus* (*Xenopygus*) *analis*, Erichson, destroy fruit-fly larvae in some numbers. The puparia are usually formed in the soil, which the larvae enter on leaving infested fruit. The time spent by the insect in the puparium ranges from 12 days at 87·8°F. to 107 days at 53·4°. The percentage of puparia that gave rise to adults was 69·3 in moist and 4·6 in dry soil. Some emergence occurred from puparia of *A. striata*, Schin., that had floated on water for four days. Exposure of puparia of *A. ludens* to 103·1°F. for more than 20 hours or to 104·9° for about 13 hours was required for complete kill. Pupae were more resistant to low temperature when the puparia were newly formed than after two days, but there was marked resistance after four days.

Over 95 per cent. of the adults emerge from the puparia in the early morning. Exposure to sunlight or an increase in temperature apparently stimulates emergence ; males tend to emerge before females. The length of the pre-mating

period (8–34 days) probably depends on temperature, and males seem to reach sexual maturity before females. Unmated females commonly deposit eggs, but oviposition usually begins soon after the first mating; one female laid 401 eggs. Few eggs are laid by very old females, and only a small proportion of these are viable, but viable eggs were produced by females as much as nine months old. The mortality among adults of *A. ludens* was remarkably low when flies kept under natural variations of temperature were exposed to 32°F. or below on 20 occasions over a period of two months. During 11 of the last 13 days of this experiment, a minimum of approximately 23·8°F. was recorded in the cages. The flies became fairly active during the day when the average noon temperature reached 63·5°. Many flies are killed by high temperatures, however, especially if exposed to the sun. They seek the shaded sides of leaves and fruits at mid-day. Mortality was rapid at constant temperatures ranging from 103·28 to 109·58°F. Three females lived for as long as 11 months in the laboratory, and four males were still living in another test at the end of 16 months.

The authors give detailed descriptions of the larva and adult, and state that spiracular processes proved of value in differentiating the larvae. Ovipositors of two types were found when specimens of *A. ludens* from different localities were examined.

Studies on sterilisation of fruit containing larvae of *A. ludens* by the vapour-heat process [*cf.* **20** 571] showed that an 8-hour approach followed by a 6-hour exposure at 110°F., with saturated vapour throughout the full 14 hours, was sufficient to ensure complete mortality. The results from the sterilisation of mangos were promising, but the samples of *Citrus* fruit used were too variable to give adequate results. Larvae of *A. striata* proved more resistant to this treatment than those of *A. ludens*. In experiments on the effectiveness of exposure to low temperatures, a security value of 99·997 per cent. mortality [*cf.* **28** 491] was indicated when the fruit was kept at 30–31°F. for 15 days, 32–33° for more than 18 days, 33–34° for 20 days or 34–35° for more than 22 days. Various methods for the disposal of infested fruit are discussed; if it is buried under 18 inches of carefully packed soil, the adults that emerge cannot escape.

Of 495 materials tested in traps of different types, 69 showed some attractiveness to adults of *A. ludens*, but only essence of white wine and resinol spikenard were attractive to any marked extent. Decomposition products of protein material such as casein were very attractive to *A. striata*, but not to *A. ludens* [**28** 468]. Fermenting sugar solution was attractive to *A. ludens*. Yeast in sugarless media gave very good catches, and yeast in water or dilute alcohol was promising. These materials were more attractive in summer than in winter. A culture in broth of bacteria from uninjured mango fruit was more attractive than the fermenting sugar solution, and the attractiveness of cultures of wild yeasts indicated that further studies should be made with them. Various extracts of food-plants were not attractive. The use of screens of different mesh to exclude moths from the standard glass traps reduced the number of fruit-flies captured.

In laboratory tests, a bait-spray of nicotine sulphate at concentrations of 1 : 200 or 1 : 300 in an aqueous solution of 5 per cent. molasses was effective over a long period under conditions of low humidity, but both toxicity and nicotine content decreased rapidly when the humidity was high. The toxicity of the solutions remained fairly uniform up to about pH 6·3, but decreased rapidly above pH 7. In field plots, sprays containing nicotine sulphate at rates of from 1 : 60 to 1 : 200, with 5–10 per cent. blackstrap molasses, caused some reduction in the number of flies, although the actual control never much exceeded 50 per cent. The reduction in fly population was greater in plots sprayed with 4 lb. lead arsenate per 100 U.S. gals. water containing 4 per cent. blackstrap molasses. In preliminary toxicity tests with many compounds,

saponins were very toxic, and the flies died rapidly when exposed to sweetened decoctions of the leaves and stems of *Haplophyton cimicidum*. Trap records showed as much as 91 per cent. reduction in fly populations in grapefruit trees after the application of sprays of 4 lb. tartar emetic per 100 U.S. gals. water containing 5 per cent. molasses, but rain reduced their effectiveness.

As a result of surveys of fruit-flies in different parts of Mexico, 19 species were segregated and were shown to belong to the genus *Anastrepha* or to related genera. Detailed descriptions are given of the morphology of the ovipositor and the male claspers, the structure of which is useful in separating different species and genera. *Pseudodacus pallens*, Coq., which attacks the fruits of *Bumelia spiniflora* in southern Texas and north-eastern Mexico and was formerly included in *Anastrepha* [*cf.* **24** 537], was found to differ from members of this genus in the structure of the genitalia and in the interspiracular processes of the larvae. Larvae of *Lucumaphila sagittata*, Stone, were found in the seeds of *Lucuma salicifolia* in Mexico ; at 77°F., the time passed in the puparium was 32–33 days. *A. serpentina*, Wied., is important in Mexico because it infests *L. salicifolia* and related fruits. It has also been recorded as infesting peach, apple, pear, quince and several wild fruits in northern Mexico, orange in Panama and grapefruit in the Rio Grande Valley of Texas. It seems evident that even when females of this species lay up to 600 eggs over a relatively short period (about 1½ months) most of these are fertile ; one female deposited 700 eggs. Adults may live for more than a year. *A. striata* usually attacks guava or fruits closely related to it, and is common throughout central and southern Mexico. *A. distincta*, Greene, commonly breeds in pods of *Inga*. Mated adults were given access to numerous fruits and other products in the laboratory, and larvae appeared in sweet lime, chilli pepper [*Capsicum*], apple and *Lucuma salicifolia*. The form known as Mexican *A. mombinpraeoptans* is distinguished from the true *A. mombinpraeoptans*, Seín, which infests mangos in Porto Rico, by certain differences in morphology and habits [*cf.* **33** 52]. Large numbers, reared from *Spondias* sp., were offered various fruits, including mangos, for oviposition, but the only ones infested were fig, yellow mombin (*Spondias* sp.) and yellow plum (*Prunus* sp.). Adults survived in the laboratory for many months, and one lived for 13½ months. *A. fraterculus*, Wied., attacks various fruits, including peach, *Citrus*, guava, *Spondias* and *Eugenia*, in South America. The form found in Mexico is referred to as Mexican *A. fraterculus* because of its different habits and because there are certain morphological differences between it and the South American form. The form attacking guavas, and to some extent peaches, in northern Mexico appears to be the same as that attacking tropical almond (*Terminalia catappa*) and *Eugenia jambos* in the south, but it is not yet known whether the two forms are in all ways identical. Mexican *A. fraterculus* has not been found to attack *Citrus*. Mexican examples of *A. chiclayae*, Greene, reared from a species of *Passiflora*, differ somewhat from the original form described from Peru, of which the host-fruit is unknown. *A. aphelocentema*, Stone, which resembles *A. ludens* superficially, attacks a fruit that apparently belongs to the genus *Lucuma*, but failed to infest various other fruits in the laboratory. *Toxotrypana curvicauda*, Gerst., is the commonest fruit-fly attacking papaya in central and southern Mexico. Examples taken in Texas and north-eastern Mexico differ from the typical *T. curvicauda*, and principally attack the fruits of a vine of the milkweed family.

McGregor (E. A.). **A new potential Enemy of the Bud Mite.**—*Calif. Citrogr.* **30** no. 2 p. 53, 1 fig. Los Angeles, Calif., 1944.

The author reports that a mite identified as *Cheletogenes ornatus*, C. & F., was frequently observed feeding on the bud mite [*Eriophyes sheldoni*, Ewing] on lemon in San Diego County, California. It was very common in the orchards visited, particularly in densely populated colonies of the bud mite,

where many dead bud mites were observed. It was also found feeding on *Tarsonemus bakeri*, Ewing, in Los Angeles County.

Austin (L.), Yuill (J. S.) & Brecheen (K. G.). **Use of Shoot Characters in selecting *ponderosa* Pines resistant to Resin Midge.**—*Ecology* **26** no. 3 pp. 288–296, 4 figs., 7 refs. Lancaster, Pa., 1945.

An undescribed Cecidomyiid of the genus *Retinodiplosis* is injurious to ponderosa pine (*Pinus ponderosa*) in California. It is apparently restricted to this and other closely related western pines and prefers sapling and pole-size trees. Nursery trees are not ordinarily attacked. It has one generation a year. The eggs are laid in late spring on the new shoots, and the larvae hatch in about six days and enter the soft tissues of the shoots, where they form resinous pits in the vascular tissue, apparently feeding on secretions from the tree. In the following spring they migrate to the bark and needles and pupate in cocoons. The adults emerge about three weeks later. Heavy infestation retards growth, causes stunting, impairs the quality of the timber, and sometimes kills the tree. No method of control is known, but observations in 1939 in a large plantation containing many distinct forms of *P. ponderosa*, in which infestation had first been observed in 1936 when the trees were seven years old, showed that though some forms were severely attacked, others were very little infested. Further investigations showed that the new shoots of various trees were glaucous, glabrous or viscid and that those trees with viscid shoots, practically irrespective of degree of viscidity, were seriously injured while the others were relatively unharmed. When estimates were made two years later, it was found that injury was slight or absent in about 93 per cent. of the glaucous trees, 77 per cent. of the glabrous ones, and only 22, 15 and 11 per cent. of the slightly, moderately and very viscid ones. It is suggested, therefore, that trees susceptible to attack by the midge might quickly be selected for removal from the stand by observation of the surface of the shoots.

Balch (R. E.) & Bird (F. T.). **A Disease of the European Spruce Sawfly, *Gilpinia hercyniae* (Htg.), and its Place in Natural Control.**—*Sci. Agric.* **25** no. 2 pp. 65–80, 1 fig., 16 refs. Ottawa, 1944.

The outbreak of *Gilpinia hercyniae*, Htg., on spruce in Canada reached a peak in 1938, after which it declined [*cf. R.A.E.*, A **32** 111] until no important defoliation was being caused by 1943 [*cf.* **33** 155]. This decline coincided with, and was apparently caused by, a disease of the larvae that was observed first in the laboratory in 1936, became abundant in parts of New Brunswick, Vermont and New Hampshire in 1938 and was distributed throughout most of the range of the sawfly in Canada by 1942. It was first noted in heavily infested areas, but has since caused considerable mortality in others. Its origin is uncertain but it may have been introduced with parasite material, since evidence was obtained in the course of work on sawfly parasites in Europe that it was present in *Gilpinia polytoma*, Htg., and that *G. pallida*, Klug, *Diprion pini*, Schr., and *Neodiprion sertifer*, Geoffr., are also affected by it.

The authors discuss the extent of the natural control of the various stages of *G. hercyniae* before the disease appeared, and conclude that the destructiveness of the sawfly until 1938 was due to the fact that it was in a region where food was plentiful over vast areas, the climate was favourable and the biotic factors of control were insufficient to prevent an increase of population until the factor of food shortage was added. By 1938, however, several species of introduced parasites had begun to exert considerable additional control in many districts, while the disease was beginning to affect the sawfly in the more southerly parts of its range. In 1939, both disease and parasites increased in effectiveness [*cf.* **29** 531–532], but the disease became the chief factor in causing a general reduction of the outbreak. If it disappears, the introduced parasites may again become important in maintaining control.

The results of various methods of comparing the mortality from disease with the total larval mortality, which are discussed, showed that the disease was the major factor in control during 1939–41 and was capable of reducing the numbers of sawflies regardless of other factors. Before its appearance, other factors were causing a mortality of 85–95 per cent. or more ; the parasites, which were increasing rapidly, might have been capable of bringing the average mortality in each generation above the 97 per cent. theoretically necessary to maintain a static population of the sawfly before scarcity of foliage and the dying of trees added the factor of starvation, but the disease accomplished this before the potential value of the parasites could be ascertained, and destroyed so large a proportion of the population that other factors became of minor importance. It continued the dominant factor in the control complex at least up to 1942, but will probably not remain so after the population has been reduced to a certain level, which may already have been reached.

Notes are given on the nature of the disease [*cf.* **32** 111], which appears to be similar to the virus or wilt diseases of Lepidoptera, including descriptions of the external and internal symptoms. Infection occurs by ingestion, and larvae can easily be infected by allowing them to feed on foliage that has been smeared or sprayed with water containing the body fluids from diseased living or dead larvae. The disease is extremely contagious, but healthy larvae in still air have become infected only after direct contact with diseased larvae or surfaces that have been contaminated by them. The spread of the disease through the air is dependent on the presence of water or dust particles that have been in contact with the pathogen and on air currents sufficient to carry them, but it is improbable that spread by this means is sufficient to produce the rapid dissemination that occurs in nature. Experiments in progress indicate that under certain conditions the pathogen is carried into the cocoon without killing the insect so that the emerging adult is contaminated, and this may be an important means of overwintering and spread since the adults often fly long distances. It is uncertain whether the pathogen overwinters on the foliage. The disease does not appear in the field until about the middle of July, showing that the foliage is not heavily contaminated in spring. One experiment showed that contaminated foliage lost its infectiveness during one month of sub-zero weather, but the pathogen survived in dead larvae stored at just below freezing point for 13 months and in water at room temperature for at least three months.

The evidence indicates that the disease originates in the alimentary tract and can only infect larvae in the five feeding instars ; all the later stages of the sawfly remained uninfected even after immersion in water-extract of diseased larvae. If larvae that become infected in the fifth instar enter the sixth and void the gut before the period of incubation of the disease is over, normal development to the adult stage can take place, and although the adult is not affected, it can transmit the disease to some of its off-spring. It is not known whether the pathogen can be carried through the egg, but the egg does not appear itself to be affected. No cases of individual immunity or resistance were observed among feeding larvae. There is little to suggest that the disease is greatly influenced by weather conditions ; density of sawfly population seems to be the most important factor determining its control effect, the percentage of diseased larvae increasing with the population, independently of secondary effects of crowding, such as shortage of food. There is probably a minimum level of population on which the disease can maintain itself when all the adults have emerged from cocoons formed by infected larvae, and it is already becoming less prevalent at points in New Brunswick [*cf.* also **32** 326 ; **33** 47], and may disappear from considerable areas to reappear only after new outbreaks of the insect develop. The possibility of storing the pathogen in virulent form, so that it can be re-established if necessary, is being investigated.

[Florov (D. N.).] **Флоров (Д. Н.). The Larch Tortricid (*Steganoptycha diniana* Gn. *desertana* Caradja) in eastern Siberia.** [*In Russian.*]—*Bull. Inst. sci. Biol. Géogr.* **9** no. 3–4 pp. 169–207, 12 figs., 19 refs. Irkutsk, 1942. (With a Summary in English.) [Recd. 1945.]

In July 1937, a serious outbreak of *Enarmonia* (*Steganoptycha*) *diniana*, Gn., was reported in forests of larch (*Larix sibirica*) over an area of more than 4,000 sq. miles, chiefly in the west of the Buryat-Mongol Republic (Transbaikalia) but extending into an adjoining district in the Province of Irkutsk. No previous outbreak of this Tortricid has been recorded from the Russian Union, and examination of moths taken in the infested area showed them to belong to the Siberian form, *E. d. desertana*, Caradja. All stages of this form are described, and the synonymy and distribution of *E. diniana* reviewed. In the area of the outbreak, infestation was heaviest in pure stands of larch situated at altitudes of 4,200–6,500 ft., and decreased in severity at lower altitudes.

Observations on the bionomics of the moth were carried out in the laboratory at 22–25°C. [71·6–77°F.], in insectaries placed outdoors, and in the forest. There was only one generation a year. The adults were present in July, August and September, and females constituted 60 per cent. of the population. Dispersion was apparently by flight, and carriage by wind was not observed. Pairing took place some 4–5 days after emergence, and the oviposition period, which began a few hours later, lasted 10 days, or up to 18 if the weather was cold and wet. Adults survived in the laboratory and insectaries for about a month. The eggs are laid singly or in small batches at the base of young shoots and buds and overwinter. Their development ceases at low temperatures, but they survived even when the temperature fell to —45 and —50°C. [—49 to —58°F.]. Eggs laid on trees on the southern slopes of the mountains, in open places exposed to the sun, or in the upper part of the tree, hatched earlier than those in shady, cold or damp sites. The minimum and optimum temperatures for egg development are 5–7°C. [41–44·6°F.] and 12–15°C. [53·6–59°F.], respectively.

In the Province of Irkutsk, the larvae appeared in numbers between 18th and 27th May. They first fed on the flowers, causing them to wither and drop, or attacked the young needles at the base, and later migrated to fresh needles and webbed them tightly together in the shape of a funnel, in which they fed. Eventually they abandoned these funnels and fed openly on the needles, migrating all over the tree and covering it with webbing, which sometimes formed a dense net. Their feeding causes complete defoliation, and it is calculated that one larva destroys about 400 needles during its life. Pupation began about 25th June ; naked pupae were formed just below the surface of the litter. In the forest, at a mean day temperature of 15–18°C. [59–64·4°F.], the pupal stage lasted 16–19 days, with a minimum of 13–14. The larvae were not observed on trees other than *L. sibirica*, and in cage experiments they did not feed on the foliage of various other conifers and broad-leaved trees or on grasses. Injury to larch was less severe in mixed stands, but many trees that had been defoliated in three successive years became weakened, were attacked by secondary pests, such as bark-beetles, and dried out.

No information on mortality among the overwintering eggs was obtained, but it is believed to be heavy. Many are killed by cold spells following an early spring, which stimulates development. Late springs with a gradual thaw and steady increase of temperature, favour development, and a mass increase results if such conditions occur in several consecutive years. Outbreaks in eastern Siberia are probably periodic, as they are elsewhere [*cf. R.A.E.*, A **18** 434]. The outbreak studied probably began in 1934, reached its peak in 1937 and began to die out in 1938, owing chiefly to the activity of parasites, which in that year destroyed about 75 per cent. of the larvae.

Lists are given of the parasites recorded from larvae and pupae of *E. diniana* in the literature and of those bred from them by the author in 1938. The latter comprised 21 Ichneumonids, 8 Braconids, 1 Eulophid and 3 Tachinids. The most important were *Angitia exareolata*, Ratz., and *A. apostata*, Grav., which together constituted 75 per cent. of all the parasites reared. In the forest, adults of these Ichneumonids were most abundant between 10th and 25th June, and they attacked larvae in all except the first instar. They left their hosts to pupate, and the pupal stage lasted 12–15 days in nature and 9–11 days in the laboratory. Besides parasites, an unidentified disease of the larva contributed to the collapse of the outbreak. Other enemies included insectivorous birds and small rodents.

No control measures were tested in the field, but laboratory investigations showed that most of the insecticides usually applied against defoliating insects were effective against *E. d. desertana*, the best being calcium arsenite, which should be applied from an aeroplane at the rate of 7–9 lb. per acre during the period when the larvae are feeding openly on the needles. This occurs approximately between 10th and 20th June at the lower altitudes and 20th and 30th June at the higher ones.

DA COSTA LIMA (A.). **Insetos do Brasil. 5.° Tomo. Lepidópteros. 1.ª parte.** [Insects of Brazil. Vol. 5. Lepidoptera. Part 1.]—379 pp., 235 figs., many refs. Rio de Janeiro, Escola nac. Agron., 1945.

In this first part of a volume dealing with the Lepidoptera, information is given on the morphology and biology of ten superfamilies, together with notes on the species of economic importance in Brazil. There are a general introductory account of the anatomy, biology, and classification of the Order, keys to the sub-orders and superfamilies, and extensive bibliographies. The superfamilies dealt with are the Micropterygoidea, Hepialoidea, Incurvarioidea, Nepticuloidea, Cossoidea, Castnioidea, Zygaenoidea, Tineoidea, Tortricoidea and Pterophoroidea.

SANTORO DE CROUZEL (I.). **First Instar Larva of** *Acridiophaga caridei* **(Brèthes) (Diptera : Sarcophagidae).**—*Proc. ent. Soc. Wash.* **46** no. 9 pp. 239–246, 12 figs., 5 refs. Washington, D.C., 1944.

A detailed account is given of the morphology of the first-instar larva of *Sarcophaga* (*Acridiophaga*) *caridei*, Brèthes. This was the most important of the parasites of *Schistocerca paranensis*, Burm., studied in Buenos Aires in 1938–40 [*cf. R.A.E.*, A **26** 147].

DARROW (G. M.), WILCOX (R. B.) & BECKWITH (C. S.). **Blueberry Growing.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1951, ii + 38 pp., 23 figs., 2 refs. Washington, D.C., 1944.

This bulletin contains a section (pp. 34–38) dealing with the bionomics and control of pests that attack blueberry in the United States. They include *Rhagoletis pomonella*, Walsh, which has not caused serious injury in Michigan and North Carolina, but is present in both wild and cultivated fields in New England and Pennsylvania [*cf. R.A.E.*, A **30** 535; **32** 282]; *Mineola vaccinii*, Ril., and other fruitworms [*cf.* **30** 119; **32** 282]; the Coccids, *Diaspidiotus* (*Aspidiotus*) *ancylus*, Putn. [*cf.* **32** 283], which can be controlled with a dormant spray of winter-strength lime-sulphur in water (1 : 8) applied thoroughly to old stems with rough bark, and *Lepidosaphes ulmi*, L., and *Eulecanium* (*Lecaniuin*) *nigrofasciatum*, Perg., which are more obvious, but do no serious damage; and the mite, *Eriophyes vaccinii*, Keifer [*cf.* **29** 259].

Anthonomus musculus, Say, which occurs in the eastern States and has one generation a year [*cf.* **15** 84], reduces the blueberry crop by more than 50

per cent. in many places. The adults overwinter under débris or in other places of concealment; a permanent mulch in the field encourages them to remain there, whereas clean cultivation forces them to hibernate elsewhere. They become active in spring and bore into the swelling leaf and fruit buds, so that some do not open and others produce malformed leaves. They pair soon after hibernation, and begin to oviposit as the blossoms show white; the female punctures the corolla and lays a single egg, usually among the anthers. The larva hatches in a day or two and eats the stamens, pistil and part of the ovary, leaving only the shell of the flower, in which it pupates. If the weevils occur in a narrow strip along the edge of a field, injury can be reduced by dusting with pyrethrum whenever they become numerous; repeated applications must be made between the swelling of the buds and the opening of the flowers. To protect an entire field it is necessary to cover all leaf and fruit buds well with a spray of 3 lb. lead arsenate per 50 U.S. gals. when the fruit buds swell.

Cutworms, especially *Rhynchagrotis anchocelioides*, Gn., sometimes eat the fruit buds as they swell in spring, but can be controlled by eliminating leaves and débris on the field and applying a poison bran bait. Blueberries are occasionally defoliated by the migrating larvae of *Malacosoma disstria*, Hb., which can be controlled by the use of ditches to stop migration, or by knocking the larvae off the bushes into a pail; by *Hyphantria cunea*, Dru., which is common in spring and autumn and is controlled by removing the webs formed by the colonies at the end of twigs and destroying the larvae; and by *Datana angusi*, Grote & Rob., the larvae of which usually feed in colonies of about 100 and can also be removed by hand.

The Pteromalid, *Hemadas nubilipennis*, Ashm., forms galls on the stems and may become numerous enough to reduce the crop, but can be controlled by cutting off and destroying the galls during winter pruning. The Lamiid, *Oberea myops*, Hald., deposits its eggs singly beneath the bark between two parallel girdles of punctures cut round the stem about half an inch apart. The larva tunnels down the stem to the base of the plant in two years and sometimes enters another stem in the third, before pupating and transforming to the adult stage. Control is effected by cutting the wilted tips well below the girdled area during July or by removing all tunnelled shoots while pruning. The larvae of *Rhabdopterus picipes*, Ol. [*cf.* **32** 152] feed on the roots and the adults on the leaves of cranberries and other bog plants, including the native blueberry, and when land covered with these plants is cleared for cultivated blueberries, the entire infestation is concentrated on the latter, and serious injury may follow. The eggs are laid in the soil, and the larvae feed until winter, and again in spring until late May, when they pupate; as a result, the plants wilt and sometimes die. The adults are active from about mid-June until the end of July, feeding on the foliage on cloudy days and at night, and hiding in the soil or under rubbish during the hottest part of the day. In the absence of a large initial infestation there is little danger from this Eumolpid, and the most satisfactory method of control is to plough the land a year before it is to be used and keep it fallow until planting time, so that the insects starve or migrate. The Japanese beetle [*Popillia japonica*, Newm.], the plum curculio [*Conotrachelus nenuphar*, Hbst.], the rose chafer [*Macrodactylus subspinosus*, F.] and the European corn borer [*Pyrausta nubilalis*, Hb.] are common on garden plantings of blueberry.

AITKEN (T. R.). **A Note on the Damage to Wheat caused by the Indian Meal Moth.**—*Cereal Chem.* **20** no. 6 pp. 700–703, 5 refs. Lancaster, Pa., 1943. [Recd. 1945.]

The necessity for storing quantities of wheat in bulk for long periods has created new problems in North America, including the control of insect

infestation and the grading of grain damaged by insects. An examination was therefore made in Canada of the reduction in quality of wheat caused by larvae of *Plodia interpunctella*, Hb., which confine their feeding to the germ portion of the kernel and remove this entirely. Tests of samples of normal kernels and kernels that appeared normal but for the removal of the germ, selected from grain that had been undisturbed for about two years and had been heavily infested by *Plodia* during the second summer of storage, showed a lower proportion of mill offals and a higher proportion of flour for the damaged wheat, as was to be expected, since the proportion of endosperm to offal-producing material in it is higher, but otherwise the milling characteristics of the two were essentially the same. Differences in the protein contents in the two series were small in the case of the wheats, bran and flours, but distinctly higher in the case of the bran-chips, shorts and feed flour; moreover, the flour had higher contents of ash and yellow pigment, expressed as carotene. Gassing power, expressed as ml. total gas evolved, was almost identical for the two flours. The thiamine contents for the flours from normal and damaged wheat were 1·61 and 0·47 mmg. per gm., respectively, indicating that the scutellum and epithelium were also removed partly or completely, and that a relatively low percentage of damaged kernels in the mill mixture would lower the thiamine content of the flour appreciably. Baking data showed hardly any differences in absorption or dough-handling properties, but the flour from the damaged wheat gave a loaf that was inferior in all characteristics; the volume was reduced by almost 9 per cent., and the crumb texture and crumb colour were affected.

Lepesme (P.). **Les Coléoptères des denrées alimentaires et des produits industriels entreposés.**—*Encycl. ent.* (A) **22** [4+] 335 pp., 12 pls., 233 figs., 31 pp. refs. Paris, P. Lechevalier, 1945. Price *Fr.* 350.

The greater part (pp. 3–241) of this book consists of notes on the appearance, habits and distribution of beetles that have been found in various parts of the world in association with stored products, structural timber, wooden furniture, fabrics, insect collections, etc., whether as pests, or, in a minority of cases, as scavengers or predators. They are arranged systematically, with numerous keys, and those of greater economic importance are dealt with in more detail. The second part consists of brief discussions of the ecological conditions provided by the various habitats of these beetles, and their influence on bionomics, feeding habits, distribution, etc., the relations between the beetles and other organisms and methods of control. It includes lists of parasites and predators showing their distribution and the species that they attack.

Delassus (M.) & Lepigre (A. L.). **La conservation des grains emmagasinés. Les problèmes qu'elle soulève.**—30 pp. Algiers, Dir. Écon. algér., Serv. Déf. Cult., 1942. [Recd. 1945.]

The authors discuss, with special reference to Algeria, the damage caused to stored grain by heating and insect attack and give notes on the bionomics of species of *Calandra* and *Tribolium*, the effect of methods of storage on the increase of insects and on heating, and preventive measures that may be taken in silos and warehouses, including control by movement of the grain and by high or low temperatures. The greater part of the paper consists of information on the nature and use of various fumigants, of which ethylene oxide is preferred, and dosage tables for applications in buildings of various types are included.

SMITH (J. H.). **The Protection of Seed Potatoes from Tuber Moth Attacks.**—*Qd agric. J.* **59** pt. 5 pp. 289–290. Brisbane, 1944.

The ways in which potato tubers become infested by *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., and methods of protecting them in storage by means of derris dusts [*cf. R.A.E.*, A **33** 31, 187] are described. In Queensland, the damage to stored tubers is of particular importance in the case of seed potatoes harvested in November and kept for planting in February or March, as the eyes may be completely destroyed. Methods of protection less efficient than treatment with derris are distributing naphthalene liberally in and among the tubers to repel the moths, and covering the tubers with thick straw; the straw cover excludes the moths, but breeding continues under it if the potatoes are infested.

TAYLOR (W. L.). **Ornithology and Forest Insect Pests.**—*Forestry* **18** pp. 1–11, 1 fig., 12 refs. London, 1944.

The author discusses the value of birds in destroying insects in forests and describes an experiment begun in England in 1942 in which nesting boxes, the construction and use of which are described, were successfully used to attract insectivorous birds to hardwood enclosures in the Forest of Dean, though it is too early yet to note any consequent effect on insect pests. Lists are given of the insects of which remains were identified from the nests of several such birds in 1942 and 1944.

SPEYER (E. R.). **Animal Pests.**—*29th Rep. exp. Res. Sta. Cheshunt 1943* pp. 53–59. Cheshunt, Herts., 1944.

Work on the control of *Tetranychus telarius*, L., on glasshouse tomatos in Hertfordshire was continued in 1943 [*cf. R.A.E.*, A **32** 103]. In experiments on the value of cultural methods to induce early vigorous growth, the application of top-dressings of proprietary fertilisers or a mixture of dried blood and superphosphate did not check infestation, even when made earlier than is usual in commercial practice, but the incorporation of a liberal dressing of stable manure and fertilisers into the soil induced growth vigorous enough to enable the plants to withstand severe infestation without loss of crop until oil-emulsion sprays could safely be applied. In experiments in which potted plants 18–24 ins. high were sprayed with six proprietary oil emulsions, the mortality percentages for active and resting stages of the mite and for eggs were 41–81, 78–100 and 97·5–100, respectively, on leaflets that were removed from the plants 24 hours after spraying and examined nine days later, and rather higher for active and resting stages on leaflets removed and examined eight days after treatment. As it was thought possible that absorption of the oil by the leaf surface enabled active mites to survive, further experiments were made in which calcium chloride, which is hygroscopic, was included as a corrective. Preliminary tests showed that this salt is harmless to the plants and kills small, but significant, numbers of mites at concentrations of not more than 0·25 per cent., and when it was incorporated at this concentration in the oil-emulsion sprays, the mortality percentages among the active and resting stages and eggs were 82–96, 91–100, and 100, respectively, three of the sprays giving complete mortality of the resting stages. One of the emulsions caused severe injury to the foliage seven days after application when used without calcium chloride, but only slight injury developed after twelve days when the salt was included. The percentage mortalities at the end of August among active and resting stages on the heavily-infested plants used in the cultural experiments were 72 and 87, respectively, when the salt was included in the oil emulsion and 47 and 100 when it was not. When other plants, about 8 ft.

in height, were sprayed twice with oil emulsion at an interval of five days no active or resting stages were found alive, and few of the eggs were viable.

Observations in various tomato houses indicated that infestation of the plants begins in the rows near the central path unless plants already infested in the propagating house are distributed at random. It is probable that the female mites crawl upwards on the greenhouse structure when about to hibernate, and overwinter outside the house near the ridge. In spring, they drop on to the plants nearest the centre path when the ventilators are opened. It may therefore be sufficient to spray only these plants early in the season in order to keep the mite in check.

Further experiments in January–March confirmed previous findings of the value of germinating wheat between rows of lettuce in a glasshouse in protecting the latter from attack by larvae of *Agriotes obscurus*, L., in soil containing high populations of this wireworm [*cf.* **32** 104].

JONES (J. R. E.). **The Elaterid Population of Mid- and West Wales.**—*Proc. zool. Soc. Lond.* **114** pt. 3 pp. 350–359, 3 figs., 12 refs. London, 1944.

The following is largely the author's summary. This paper is based on the identification of all the Elaterid larvae and adults occurring in soil samples taken from 1,871 grass and arable fields in seven counties in central and western Wales between November 1941 and December 1943. A list is given of the species found, together with some discovered in the course of general collecting in the vicinity of Aberystwyth. The most important were *Agriotes obscurus*, L., *A. lineatus*, L., *A. sputator*, L., and *Corymbites cupreus*, F. Larvae of *Athous* spp. were not particularly common and their numbers exceeded 100,000 per acre in only 15 of the fields. In isolated instances, *C. sjaelandicus*, Müll. (*tessellatus*, auct.), a small species of *Corymbites*, sens. lat., probably *C.* (*Calambus*) *bipustulatus*, L., and *Hypnoidus* (*Cryptohypnus*) *riparius*, F., occurred in numbers sufficient to constitute a possible danger to crops. The proportion of the total population at four different altitude categories made up by each of five species groups into which the larvae were classified are shown in a histogram, and the populations of each group at the various altitudes are shown for each county in a table. Over the region as a whole, there was an indefinite tendency for populations to increase with altitude and for the composition of the total population to change, particularly in fields over 1,000 ft. where the three common species of *Agriotes* made up only 62·8 per cent. of the total population instead of 95·4 per cent., which was characteristic of lowland fields [*cf. R.A.E.*, A **32** 434]. In upland fields, *Agriotes* is largely replaced by species of *Corymbites*, particularly *C. cupreus*, which is probably an important pest in a high proportion of fields above 1,000 ft. and in many at 600–1,000 ft. The records of adults of *Agriotes* in the soil samples indicate that *A. obscurus* is the dominant species at all altitudes, especially at high elevations, and that *A. lineatus* is commoner than *A. sputator*, which is rare above 600 ft. and absent above 1,000 ft.

The average total Elaterid population per acre for the area is 218,800. Populations of 600,000–999,000 per acre were recorded in 117 fields, and of over 1,000,000 in only 28. There is some evidence that, as the total population increases, *Agriotes* spp. tend to form an increasing proportion of it, and that fields of high population tend to be grouped together.

HAMNETT (G. G.). **An Investigation into the Life-history and Morphology of the Mustard Beetle, *Phaedon cochleariae*, F., on Watercress.**—*Proc. zool. Soc. Lond.* **114** pt. 3 pp. 368–381, 6 pls., 19 refs. London, 1944.

A brief account is given of an investigation of the life-history of *Phaedon cochleariae*, F., in South Wales, where it was injurious in cultivated watercress

beds [*cf. R.A.E.*, A **26** 382], together with descriptions of the eggs, the internal and external morphology of the larva and pupa, and the internal morphology of the adult.

Beetles emerging from winter quarters were collected on 28th April and caged in pairs with growing watercress plants. Most of them had died by mid-June but a few survived until the end of the month. Mating and oviposition were first observed on 2nd and 4th May, and the females deposited 25–100 eggs. There are three larval instars, and pupation takes place within an earthen cell. Previous investigators recorded two complete generations of this Chrysomelid each year, but in the present study three were observed, emergence starting on 12th June, 27th July, and 9th September. Females of the first and second generations began to oviposit on 24th June and 8th August, respectively, two days after mating. Adults of the third generation entered hibernation without having mated. The duration of the egg, larval and pupal periods of the first two generations was approximately the same (about 7–12, 19–25, and 8–12 days, respectively); the last five days of the larval stage was passed in a quiescent state within the cell in which pupation occurred. The development period of the last generation was rather shorter than that of the others.

Papers noticed by Title only.

Ludwig (D.). **The Effects of atmospheric Humidity on Animal Life** [discussion of literature, dealing chiefly with Arthropods].—*Physiol. Zool.* **18** no. 2 pp. 103–135, 4½ pp. refs. Chicago, Ill., 1945.

Averill (A. W.). **Supplement to Food-plant Catalogue of the Aphids of the World including the Phylloxeridae. Index to Genera and Species of Food Plants.**—*Bull. Maine agric. Exp. Sta.* no. 393–S, 50 pp. Orono, Me., 1945. [*Cf. R.A.E.*, A **28** 440.]

Gupta (B. D.) & Garg (R. L.). **Observations on the Distribution and Biology of *Chilo trypetes* Bisset** [on sugar-cane] **in the Dehra Dun Valley of the United Provinces.**—*Indian J. Ent.* **5** pt. 1–2 pp. 173–176, 1 ref. New Delhi, 1944. [For briefer account see *R.A.E.*, A **32** 409.]

St. George (R. A.). **Protection of Log Cabins, rustic Work, and unseasoned Wood from injurious Insects** [in U.S.A.].—*Fmrs' Bull. U.S. Dep. Agric.* no. 1582 (revd.), ii + 22 pp., 25 figs., 11 refs. Washington, D.C., 1943. [Recd. 1945.] [*Cf. R.A.E.*, A **18** 42.]

Vappula (N. A.). **Finnish Entomological Literature published in 1939-1944 including** [titles of papers on] **Economic Entomology and Control of Insect Pests.**—*Ann. ent. fenn.* **6** appx. 16 pp.; **7** appx. 15 pp.; **8** appx. 15 pp.; **9** appx. 12 pp.; **10** appx. 15 pp.; **11** appx. 13 pp. Helsingfors, 1940–45. [*Cf. R.A.E.*, A **27** 694.]

Wigglesworth (V. B.). **A Case of DDT Poisoning in Man.**—*Brit. med. J.* no. 4397 p. 517. London, 1945.

NOTICES

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